

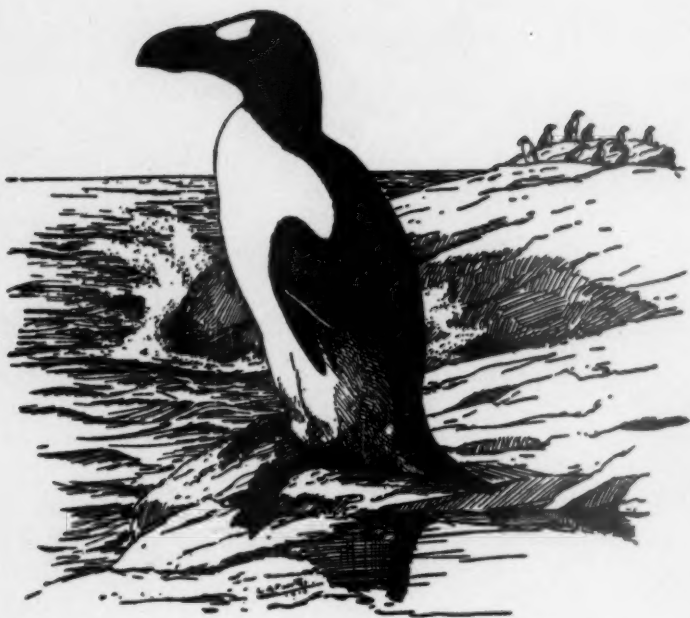
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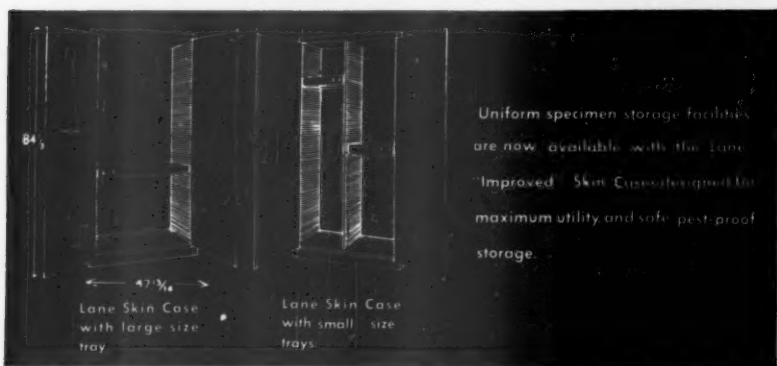
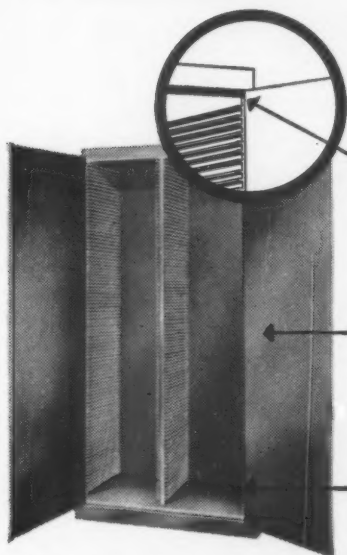
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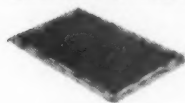


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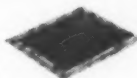
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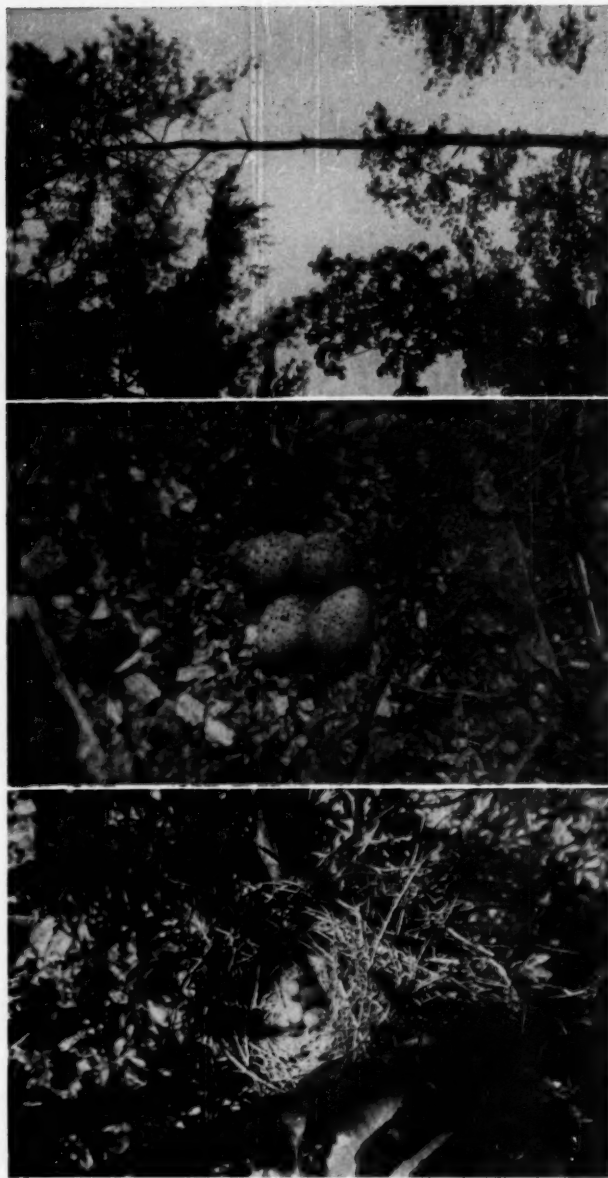
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Large Size Tray

Small Size Tray





(Left) NEST AND EGGS OF *Accipiter soloensis*. (Center) NEST AND EGGS OF *Charadrius dubius curonicus*. (Right) TYPICAL NESTING SITE OF *Butorides s. amurensis*.

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NOTES ON THE BIRDS OF KOREA

BY L. R. WOLFE

THE presently known ornithology of Korea has been admirably summed up in Dr. Austin's recent publication ('The Birds of Korea.' Bull. Mus. Comp. Zoölogy, Harvard, 101) which shows many gaps still remain in our knowledge of the bird life of this area. My recent observations have established several new nesting records for species not previously known to breed in Korea and supplied other interesting information that fills some of these gaps. The following notes are, therefore, presented to assist future workers in this little known region.

During the years 1947 and 1948 I was assigned to military duty in Korea. From February until July, 1947, I was stationed at the seaport town of Inch'on, formerly known by the old Korean name of Chemulpo but now named Jinsen on recent maps. From early July, 1947, until the last of December, 1948, I was stationed at Seoul. Poor roads, transportation difficulties, and other circumstances beyond my control limited my trips afield to week-ends or holidays. Consequently, my activities were confined principally to the area of Kyonggi Do Province and the western part of Kangwon Province. My notes are based primarily on my personal collecting, field observations during the course of military duty, and numerous hunting trips throughout this area. I collected many specimens particularly during the spring and fall waterfowl migrations, but only a few of these ended as study skins. During the entire period only about 125 skins were preserved. These have since been presented to the U. S. National Museum. For uniformity of reference I have followed the sequence of species and scientific names used by Dr. Austin in his recent book.

I wish to express my appreciation to Dr. Oliver L. Austin, Jr., for his many valuable suggestions in the preparation of this paper, and my thanks to Dr. Herbert Friedmann for verification of the reference cited in paragraph one under *Accipiter soloensis*.

Ardea cinerea jouyi Clark. JOUY'S GREY HERON.—Rather abundant summer resident and a few stragglers may be found as long as there is open water. The majority move southward in early fall and few were seen after the first week of October. The return migration begins in late February; several were observed March 10, 1947, in a marsh about 15 miles southeast of Inch'on, near the village of Sin-gil-li. By March 15 they were common along the coastal flats and beginning to appear inland. Scattered pairs soon started nest building and by the first week of April colonies were well established and some birds were incubating. I never found them nesting in lone trees as noted by Austin, but always in colonies. Frequently the majority of nests were in two or three trees with other single nests near by. Both the Grey Herons and Great White Egrets were found together in all colonies observed. Each species seemed to have its own area, although scattered pairs of one form were commonly found in the area of the other. In both 1947 and 1948 the Grey Herons were incubating full sets by the time the Egrets completed their nests. One of the largest colonies I visited was in the Chang Duc Palace grounds in Seoul. A count of this colony on April 14, 1948, indicated over 800 pairs. Fresh eggs were collected April 14, 1948, and slightly incubated eggs were seen in another colony April 25, 1948.

Butorides striatus amurensis (Schrenk). AMUR GREEN HERON.—Summer resident and common in suitable localities. Two instances were noted where five or six nests were close together in adjacent trees, but this species does not nest in colonies. More than one nest was never found in a single tree, and where nests were close together it was only due to the abundant food supply and availability of the preferred type of trees. The typical nesting site is in the top of a small slender pine in scattered woods close to open marshland. Normally the nest is placed from 20 to 35 feet from the ground and near the top of the tree. It is a frail platform of twigs, so flat on top the eggs are easily rolled out. Birds were seen carrying nesting material April 28, 1948. Fresh eggs were collected May 8, 1948. Nests with eggs nearly ready to hatch were found northwest of Seoul on May 15, 1948. Fresh eggs were again found on June 5, 1948, east of Seoul. Young just hatched were observed west of Anyang June 8, 1947.

Casmerodius albus modestus (Gray). GREAT WHITE EGRET.—Abundant summer resident. This species arrives about two weeks later than the Grey Heron. In the vicinity of Seoul it was first observed about the middle of March, and by early April birds were seen frequently feeding in the rice fields. Nesting is always of the community type, and the colonies varied from about 50 pairs to well over 1000. In general their colonies were much larger than those of the Grey, but in all cases a few pairs of Grey Herons nested close together on one side of the main gathering of Egrets. The nesting trees were always the highest in the vicinity and many of their nests were well over 100 feet from the ground. In one small colony of about 60 pairs of Egrets and 10 pairs of Grey Herons, 28 nests were counted in one huge pine. This colony was just off the main road about two miles north of Suwon. A colony at Yangsu-ri on the Han River about 25 miles east of Seoul which I visited on April 25, 1948, was estimated to contain over 1000 pairs of Egrets and about 30 pairs of Grey Herons. In this colony the nests were so thick that from a distance the sitting birds obscured the green foliage and gave the entire grove of trees a white appearance. Fresh eggs were collected April 25, 1948. Young birds nearly half-grown and fresh eggs were found May 18, 1947.

Cygnus cygnus cygnus (Linnaeus). WHOOPING SWAN.—Rare winter visitor. During January, 1948, several were often seen in the open water on the Han River

below Seoul. Swans were seen several other times but these were the only ones that were positively identified as this species.

Cygnus bewickii jankowskii Alpheraky. EASTERN BEWICK'S SWAN.—Not common, but a regular winter visitor from mid November until early in March. Numerous small flocks were seen in the sheltered bays both north and south of Inch'on. No specimens were taken personally, although several were examined that had been brought in by hunting parties.

Chen hyperborea (Pallas). SNOW GOOSE.—Rare winter visitor. A flock of about 15 birds was seen on the flats west of Chungnyul on the afternoon of February 23, 1948. Again on the evening of March 17, 1948, while in a goose blind on the marshes northwest of Il-san-ni, eight Snow Geese came in for a landing but when about 150 yards away they suddenly veered off and went on down the valley. In both instances the distinctive black primaries were seen clearly in contrast with the otherwise white plumage. They could not have been mistaken for any other species.

Anser albifrons albifrons (Scopoli). WHITE-FRONTED GOOSE.—Very common spring and fall migrant. First observed in late October, by mid November they were common on all of the suitable feeding grounds but they moved southward when the country began to freeze up. On the northward migration they were seen in February but were gone by the last week of March. During the migration of 1947 and 1948, the White-fronted Geese were much more numerous than any of the other species of geese.

Anser fabalis (Latham). BEAN GOOSE.—Common spring and fall migrant, a few remained as long as there was open water on the inland rivers. They were seen a little earlier than the White-fronted Geese, several small flocks being noted in September. During all of the fall migrations the different species of geese were usually seen in small flocks not to exceed about 20 birds. On the other hand, in the spring very few small flocks were seen and flocks of 300 or 400 birds were not uncommon.

Cygnopsis cygnoid (Linnaeus). SWAN GOOSE.—Not uncommon spring and fall migrant, but never as common as the other two species of geese. I only shot two Swan Geese, but these birds were often brought into Seoul by other hunters.

Casarca ferruginea (Pallas). RUDDY SHELLDRAKE.—Common spring and fall migrant. The earliest spring record was March 10, 1947. These birds were often seen in pairs or in small flocks on the mud flats along the coast or feeding in the rice paddies in the inland valleys.

Anas platyrhynchos platyrhynchos Linnaeus. MALLARD.—Very common spring and fall migrant; many remain as long as there is any open water. Several Mallards were shot December 21, 1947, and again on February 25, 1948. This is probably the most evenly distributed of all of the waterfowl in Korea. While never appearing in the immense flocks like some of the teals, Mallards were consistently common all through the season and in every part of the lowlands.

Anas poecilorhyncha zonorhyncha Swinhoe. SPOT-BILLED DUCK.—Rather common spring and fall migrant; a few pairs remain to nest in the vicinity of Seoul. In a small marsh about five miles southeast of Inch'on, May 25, 1947, a female was flushed from a nest containing nine eggs which were nearly ready to hatch. After she flew up, she circled over the marsh and was joined by the male; then they both settled on a nearby pond and were later examined closely through binoculars. The nest was on a slight hump in the marsh where the ground was comparatively dry. It was well concealed under a bunch of thick grass and composed of a padding of down mixed with bits of dry grass. During the summer of 1948, Spot-billed Ducks were seen several times in a coastal marsh west of Kimpo.

Anas querquedula Linnaeus. GARGANY TEAL.—Not uncommon spring and fall migrant, but not nearly as abundant as the Spectacled Teal or the Eurasian Teal. It was seen only in small flocks along the coastal marshes. No definite records were kept of this species, but one or two birds were shot on nearly every hunting trip between early March and mid April.

Anas crecca crecca Linnaeus. EURASIAN TEAL.—Abundant spring and fall migrant; they arrive early in September and the majority have gone southward by December. The spring migration begins about the first of March, but belated stragglers were seen until the last week of April. The fall migration usually consists of numerous small flocks, but in the spring they can be seen in huge flocks numbering several thousands.

Anas formosa Georgi. SPECTACLED TEAL.—Abundant spring and fall migrant but much more numerous in the spring. The first spring arrivals were seen during the last week of February. From mid March until late in April they were present on all of the marshes, sometimes in pairs but normally in huge flocks numbering thousands. These flocks would appear like fast-moving, dark clouds and the noise of wing beats could be heard when the flock was at least 500 yards away.

Anas falcata Georgi. FALCATED TEAL.—This species is a rather uncommon spring and fall migrant, and was most often seen in pairs or in small flocks. A beautiful male in full breeding plumage was shot near Gunja Station, March 21, 1948, as a pair came in over the marsh.

Anas acuta acuta Linnaeus. PINTAIL.—Very common spring and fall migrant. The first fall arrivals were seen in early October; they were very numerous during November, and then rarely seen until the big northern flights began in March and continued until about the second week in April.

Mareca penelope (Linnaeus). WIDGEON.—Not uncommon spring and fall migrant. Like the other species of ducks, they first appear in late September. The majority have moved southward by early November and are rare until the spring flights start north again in early March.

Spatula clypeata (Linnaeus). SHOVELLER.—Rather uncommon spring and fall migrant. Shovellers were shot in March and April and again in October of both 1947 and 1948. A few were observed from time to time in the bags brought in by other officers.

Aix galericulata (Linnaeus). MANDARIN DUCK.—A rather rare migrant. A male and female were shot from a group of three April 26, 1948. These were found on a small pond west of the Kimpo Airport. No others were identified positively as being this species.

Aythya fuligula (Linnaeus). TUFTED DUCK.—Rather common migrant; a few remain nearly all winter; frequently seen on the Han River as long as there was open water. Many more were observed during March and early April than at any other time. It was never seen in large flocks but small groups of 10 to 20 birds were common on all of the ponds along the coast. The latest spring migrants were seen on the marshes west of Kimpo, April 26, 1947.

Aythya marila mariloides (Vigors). GREATER SCAUP DUCK.—A male was shot March 30, 1947, from a flock of six found on a coastal pond about 15 miles north of Inch'on. No others were collected, but they were often seen along the coast during the spring migration.

Bucephala clangula clangula (Linnaeus). GOLDEN-EYE.—Rather common winter visitor along the coast and on the larger rivers. In December, 1947, and January, 1948, Golden-eyes were usually present along the Han River near Seoul.

Mergus merganser orientalis Gould. GOOSANDER.—Not uncommon spring and fall migrant. Birds were seen several times along the Han River near Seoul and on the Imjin River north of Munsan. A single female was shot on the Han River west of Ilsan-ni, November 20, 1948.

Mergus serrator Linnaeus. RED-BREASTED MERGANSER.—Rather common spring and fall migrant. They were often seen along the larger streams and wherever there was open water on the deeper ponds. Several birds were shot in October, 1947, and in March, 1948.

Milvus migrans lineatus (Gray). BLACK-EARED KITE.—Common summer resident. Birds were seen in every month of the year, but those present during the winter may have been migrants from farther north. It seems strange that nesting records of this kite have not been reported previously in Korea as it is a comparatively common breeder in all of the central area. During the spring and summer of 1948, I found two nests on Nam-San, the South Mountain overlooking the city of Seoul, another in a big tree in the heron colony in the Chang Duc Palace grounds, two more in other parts of Seoul, and I probably overlooked one or two others in the vicinity. I examined seven additional nests within a radius of 25 miles from Seoul.

This bold scavenger seems to be equally at home either in the city streets or on the uninhabited hills. During the winter months they congregate around trash dumps in the towns and villages, to feed on any available scrap or bit of refuse that may be found. They are common around all seaport towns and along the rivers where there is open water. By late March the majority have paired and scattered to their nesting localities. In April, May, and June, they are seldom seen except in the vicinity of a nest. After the young are fully grown, they all seem to move out of the country, as only an occasional bird was seen until mid September when they were again common. Possibly the local nesting birds migrate southward in the early summer, and those which appear in September are migrants from the north. However, there seems to be no logical reason why such a hardy bird should move south so early. I believe the local breeding pairs move northward to the cooler mountains during the hot summer weather and then return to their home territory in the fall.

Nest building or rebuilding, as frequently an old nest is used, begins in mid March, and by early April some pairs have started to incubate. A set of three eggs was collected April 3, 1948, on Nam-San. These were only slightly incubated. Another nest with two incubated eggs was collected May 22, 1948. Young birds a few days old were found April 25, 1948, and well feathered young were taken from a nest May 12, 1948. Every nest observed was high up in the top forks of a big tree. The favorite site is the tallest available tree on a hill or mountain side where an excellent view of the adjacent country can be had from the nest. A nesting pair was found close to or in every heron colony, and in two instances several herons nested in the same tree with the kite. The kites seemed to respect the heron property as long as there was a heron on the nest, but if the nest was left unguarded one of the kites would quickly make a swoop for an egg or a young heron.

The nest of the kite is a big, compact affair, very filthy and especially odorous after the young are hatched. A typical example 70 feet from the ground in the top of a pine was composed of sticks, grass, trash, a piece of rope, rags, and pieces of paper, with a lining of rags, bits of paper, mats of hair, and miscellaneous trash. The normal complement of eggs is two or three, but in two nests only a single egg was laid.

This kite is frequently quite "vicious" in the defense of its young. While I climbed to one nest with incubated eggs, the female dived at me repeatedly. Just as I reached the nest she struck me on the back and shoulder with terrific force, ripping my shirt

and nearly knocking me out of the tree. At another nest I induced a soldier to do the climbing for me. As he reached the nest the female first knocked off his cap. Then, as he hesitated, she struck the back of his head, cutting a deep gash in his neck and ripping his shirt. He was in a rather bad position and I grabbed the gun and gave her a charge of small shot which only knocked out a few feathers, but did drive her away and permitted him to descend.

Accipiter soloensis (Horsfield). BLUE FROG-HAWK.—Summer resident and common in suitable localities. Although first described in 1821, very little information about the nesting habits of this species has ever been recorded. Pere Courtois (Memoires concernant l'Histoire Naturelle de l'Empire Chinois, Tome 5, 3 me Cah. "Les Oiseaux du Musee de Zikawei" 1912: 1-98; pls. 1-13, 1914; 1916: 101-109, pls. 14-30; 1918: 111-121, pls. 31-45; and 1937: 124-159, pls. 68-103) was the first ornithologist to describe the nest and eggs. Except for his records and a nest and five eggs secured for me by Dr. L. H. Snyder in Korea in 1933 (Ool. Rec., 18 (2): 25) their nidification has remained unknown. Consequently I studied this little hawk in its summer home with unusual interest.

The first arrivals were seen on May 15, 1948, when two small hawks subsequently identified as this species were sailing over a marshy woods northwest of Seoul. During the following two weeks I saw one or more of these hawks in nearly every patch of woods around the inland valleys. After that the main flight seemed to have passed northward, or perhaps the mated pairs had just scattered to their selected nesting areas. At any rate after the first of June, birds were never seen except close to a nesting site.

Mating activities began shortly after they arrived from the south. During this period the males which are smaller were often seen chasing the females through scattered trees at incredible speed. Sometimes three or four birds were seen in the same patch of woods, flying around excitedly and often repeating a rather sharp 'kee-kee-kee' call. Once, seven individuals were seen streaking after one another through a patch of low trees not over 100 yards in diameter. During this performance sometimes one would sit out for a round, while all the others acted like they were playing tag by flying around and back and forth through the trees. At other times one left the group and flew up in the air over the trees, circled a few times and then returned to join the others. I watched one performance by two birds which chased each other for 15 minutes and then alighted close together in a pine. After a moment's rest the male flew out. Shortly thereafter he appeared overhead and sailed around and around over the immediate area. One male was seen to go through a series of aerial acrobatics. After circling low for a few minutes, he climbed steeply for several hundred feet, then suddenly set his wings and dived straight downward until just above the tree tops; then he leveled off, circled, and went up again to repeat the dive. This was repeated four times. He then leveled off and continued to circle over the tree tops for about ten minutes.

Soaring lazily in wide circles with wings almost motionless seemed to be a common habit during the early mating period, but it was observed only a few times after incubation began. While a bird might circle for 15 minutes or longer, the actual sailing time between wing-beats was never more than a few minutes. Altitude is first gained by a series of fast wing-beats, then the bird sails, gradually loses altitude, and regains height by another short series of rapid wing-beats. Except for these occasional periods in the air and the activity during the selection of mates, the species is comparatively inconspicuous. Both birds remain in the general vicinity of the nest and keep pretty well under cover, even when going out for food and returning to the nest.

In the defense of their eggs or young, a great deal of difference was noted in the actions of different pairs. Some were very bold and aggressive while other pairs were timid and retiring. One female was very noisy and made repeated dives at me when I approached the tree containing her newly built nest, although her eggs had not yet been laid. Generally during the early stages of incubation the female will slip off of the nest at the first sound of an intruder, and neither parent will be heard nor seen again. After the eggs are well incubated or when young are in the nest, the female usually appears and scolds in a series of high pitched 'kee-kee-kee-kee' notes, repeated over and over. One female with young was exceptionally bold, making repeated power dives close to me while I was at the nest. Her mate remained perched near by or circled close overhead a few times, but he made no dives. No males were observed to incubate, but several were seen to carry food to their incubating mates and there would always be some "whining" from each bird as the male neared the nest. During the latter stages of incubation or when there were young in a nest, the male was usually found on a favorite perch near the nest when he was not actively engaged in securing food.

A total of 14 nests of this species was found during June and July, 1948, in the area northwest, north, northeast, and east of Seoul, and varying from six to 40 miles from town. Two of these were deserted before the eggs were laid, perhaps because of my disturbance, but the others were all observed either with eggs or young birds. The typical nesting habitat is a small clump of chestnut trees on a low hill or along the edge of an open valley, always close to open rice fields or near marshy ground. Birds were never seen back in the higher mountains. Two nests were found in pine trees, two in water oaks and ten in chestnut trees. One was in a crotch of the main trunk, but all the others were in forks well out in the horizontal branches. The lowest nest was 20 feet from the ground, and all but one were less than 35 feet up. The exception was 48 feet from the ground in the top of a pine. The nests varied from 14 to 17 inches in diameter and averaged about five inches in depth. In all instances they were of new construction, rather frail and loosely built, and composed of small dry sticks and large twigs. The inner cup was always a mat of fresh chestnut leaves, those just beneath the eggs either fresh or slightly wilted and becoming progressively older farther down until at the bottom they were dry and brittle. Apparently fresh green leaves are added to the top of the nest almost daily during the incubation period and then less often after the young are hatched. A few nests contained occasional green pine needles or sprays of cedar mixed with the chestnut leaves. In addition to the green leaves, nearly all nests contained a few bits of bark around the outer edge of the inner nest.

The fresh eggs are a pale bluish gray but are soon stained by the green leaves to a light yellowish tan which gradually darkens as incubation advances. As a rule the eggs are unmarked, but occasionally one or two in a set are very sparsely speckled with dots of yellowish brown. The number of eggs in a nest varied from two to five. Three or four may be considered the normal number. Only one nest contained five eggs. The two that were found with only two eggs each might have been incomplete or one egg might have been lost from the nest. A series of 18 eggs from six different nests has an average measurement of 37.2 by 29.9 millimeters. The largest was 39.0 by 30.5 and the smallest 35.5 by 28.5 millimeters. Nest building begins about the first of June. Sets are completed and females are incubating by the second week of June. Fresh eggs were collected June 6, 1948; eggs with advanced incubation were found June 19, 1948; young a few days old were found July 10, and well feathered young were seen July 14, 1948.

The food of this species during the summer breeding season consists almost entirely of frogs. So far as could be determined the young were fed entirely on them. The stomachs of seven adult birds collected contained only frog remains. During the early mating season two different males were seen to catch a frog, carry it to a female, and share it with her. Several times males were seen to carry a frog to the nest to feed their incubating mates.

These birds vary a great deal in color. Most of those actually breeding were in the typical adult color phase with light bluish gray upperparts, the breast and abdomen varying from almost white to vinous pink, and some even barred rufous brown. However, some were seen with dark brown upperparts or barred with brown, and one or two were seen that were nearly a dark slaty color above. Apparently the delicate, light, bluish gray dorsal plumage is not reached until after three or four molts. In the field the males can not be distinguished from the females with certainty except by size. In hand the sexes are easily separated by the color of the iris, which is reddish brown in the male and lemon yellow in the female. At a distance this species can be confused with the Japanese Sparrow Hawk, but can usually be distinguished by its white under-wing coverts and black primaries which the latter lacks. These characters are plainly visible from beneath when the bird is in flight.

The common name of Chinese Goshawk or Horsfield's Goshawk that has been used for this species is neither appropriate nor descriptive. It breeds in north China but is not restricted to that country, so this name is not well applied. Horsfield was the original describer, but he also described many other new forms and there is little reason to attach his name. Moreover, the name of Goshawk is used only for the reason that it is an *Accipiter*, but this name is not distinctive as the bird has neither the size nor the characteristics of a goshawk. In the fully adult plumage it is a beautiful soft bluish gray color, and as frogs constitute the principal item of food during the summer breeding season the name of Blue Frog-hawk is suggested as an especially appropriate common name.

Accipiter nisus nisosimilis (Ticell). ASIATIC SPARROW HAWK.—Rather common spring and fall migrant; many were seen during the spring and in the fall but none between early April and October. There is no evidence that this species breeds in Kyonggi Do Province, but it is probably a summer resident in the highlands farther north. Specimens were shot on February 23, March 14, October 31, and November 21, 1948. While in the hills west of Kimpo, April 6, 1947, I was watching several Dusky Thrushes, *Turdus naumanni*, feeding in some low bushes about 20 yards away. Suddenly a Sparrow Hawk shot past through the bushes and picked up a thrush without ever slackening its speed.

Accipiter virgatus gularis (Temminck and Schlegel). JAPANESE SPARROW HAWK.—Rare summer resident. The first one seen was in an open woods in the Kings Tomb area east of Seoul on June 2, 1948. On June 5 while crossing a low ridge in the foothills about 20 miles north of Seoul, I saw a Japanese Sparrow Hawk in the top of a small pine. When it flew it was joined by another and larger bird which I presumed to be the female. This pair was watched for some time and their actions indicated that they were either nesting or getting ready to nest. However, several hours of searching through the scattered pines and intermittently watching the birds produced no results. The following day, June 6, in the hills north of Masogu-ri, I located a rather small nest about 35 feet from the ground in a small clump of pines; examination through the glasses disclosed a bird on its nest. I stood about 25 yards from the tree in order to see the bird when she came off the nest, and my Korean boy went up and tapped on the tree. At the first disturbance, the bird raised up

and stood on the nest for perhaps a minute before she flew off to be seen no more. I was able to examine her carefully through binoculars before she flew and to identify her clearly as a Japanese Sparrow Hawk. The nest was of new construction, built of small dry sticks and lined with dry leaves, bits of bark and a few pine needles. It contained three nearly fresh eggs which were collected. These eggs are similar in size to those of *Accipiter soloensis*, but the shell color is bluish white and all are rather well marked with small spots and thin blotches of reddish brown and pale chestnut and there are a few specks of blackish brown.

Buteo rufinus hemilasius Temminck and Schlegel. UPLAND BUZZARD.—Winter visitor but not common. In the field this species can be distinguished easily from the Japanese Buzzard by its larger size, longer wings, light colored head and nearly white tail. A pair were seen February 8, 1948, in the mountains about 16 miles east of Seoul. These birds were watched for 15 or 20 minutes as they soared around the top of a rugged peak. Two other birds were seen north of Seoul on February 24, 1948.

Buteo burmanicus Hume. JAPANESE BUZZARD.—Common winter visitor. One or more of these hawks was seen on every field trip from November until early in March. I am sure that they do not breed in Kyonggi Do Province as no birds were observed after the last week of March. Specimens were collected north of Seoul, December 7, 1947, east of Suwon, December 21, 1947, and northeast of Seoul, February 15, 1948.

Bulastur indicus (Gmelin). GREY-FACED BUZZARD-HAWK.—Summer resident. This hawk has not been recorded previously as a breeding species in Korea, but it cannot be considered rare in Kyonggi Do Province as three different breeding pairs were found in 1948. The species was first noted in the low hills east of Anyang on March 17, 1947. In 1948 the first arrivals were a week later, but in both years birds were seen intermittently until late in June.

Very little seems to have been written about the habits of this species and the few recorded notes do not agree with my observations. The Caldwells ('South China Birds,' 1931: 426) write—"very harrier-like in habits and characteristics." La Touche reports—"is said to build its nest in Japan on solitary trees in rice or other fields." I have never seen this hawk in open grass lands or in open fields. Its habits and characteristics as observed in Korea were more like those of the smaller buteos. In fact, their actions, habits, and the typical nesting site are all similar to those of *Buteo lineatus*. The three nests I found were in similar surroundings, open woods, checkered with small areas of wet grass which supported an abundant frog population. Frogs are apparently its principal diet. Each of three birds collected had the remains of frogs in its stomach, and other birds were seen to catch frogs.

While mating and nest building, both the male and female are quite noisy in the vicinity of the nesting site. The male is especially active and noisy in the late afternoons. One was observed calling from a branch of a low tree, then moving 10 or 15 yards to another perch and calling again. This was repeated until he had nearly circled the female which was all the while sitting quietly in the top of a pine.

Like the buteos, they have the habit of soaring around over the nesting area. Sometimes the male, then the female, and occasionally both are in the air together. After incubation begins, both birds are rather quiet and stay pretty much out of sight. A typical nest found May 12, 1948, was 35 feet from the ground in a small pine growing in open woods at the edge of a marshy valley. It was built against the main trunk but was supported by small branches. It was of new construction,

about 20 inches in diameter, and loosely built of dry sticks. The inner nest consisted of dead leaves, dry pine needles and bits of bark. On top of this was a lining of green leaves and a few green pine needles. This nest contained three slightly incubated eggs which were collected.

Aquila chrysaetos japonica Severtzov. JAPANESE GOLDEN EAGLE.—Rare resident. During the winter months this eagle may be seen in the valleys or over the coastal marshes, but its normal habitat is the wilder mountain districts. A Golden Eagle was seen south of Inch'on on March 10, 1947, and another near Suwon March 25, 1947.

While on a hunting trip in the mountain area of Temma-San, about 20 miles northeast of Seoul on October 19, 1947, I saw two Golden Eagles that were apparently hunting together. My hunter-guide of that day, Kim Hun Suc, told me this pair had been in the same area for many years and were there during the entire year. In early March, 1948, I again contacted this mountaineer and through an interpreter learned there were two pairs of eagles in his district. Arrangements were made with him to locate a nest. Some weeks later he reported that he had seen an eagle fly to a cliff and disappear in a hole which probably contained the nest. On April 4, 1948, I picked him up in a jeep and we started for the top of Yebong-San. This is a mountain on the north side of the river, about 35 miles directly east of Seoul. By mid-afternoon we had arrived at the head of a narrow valley well up in the mountain and had to abandon the jeep. After a most difficult climb we came out on a crest near the top of the mountain. Kim pointed to a ledge on the opposite side of a narrow gorge, probably 600 yards away directly across the valley. Through the binoculars I saw sticks in a dark pot hole but could not distinguish the outline of a nest. In the hope that this was an occupied nest I fired a shot in the direction of the cliff. As the sound echoed over the ravine a Golden Eagle came off of the nest, flew low down the valley and then around the mountain.

It took us another hour to circle around the head of the gorge to the base of the cliff. In the meantime the eagle had returned to the nest. As we started to climb around the ledge to get above the nest, she flushed just over our heads. She returned soon and for a short time perched on a dead stub not over 50 yards away. Through the binoculars I was able to examine every detail, the most prominent character being the almost pure white feathers of the tarsi. The nest contained one egg nearly ready to hatch and a newly hatched chick. Both were taken. The egg is now in my personal collection and the skin of the chick is in the U. S. National Museum. This nest was about 30 feet from the top of a 75-foot cliff and about 10 feet back in a well protected crevice. It had apparently been used for many years as the base was a huge pile of partly decayed sticks. On top of this were new sticks, branches, and bunches of straw. The inner cup was lined with dry grass and a few sprays of cedar.

While on the upper slopes of Chomma-San, on April 16, 1948, I located another eagle's nest in a pocket about 25 feet from the top of a 100-foot cliff. On this trip we had no rope, so I was unable to get down to the nesting ledge, but from the amount of droppings on the edge of the nest it must have contained young birds.

Haliaeetus albicilla (Linnaeus). WHITE-TAILED SEA EAGLE.—Rather common winter visitor. This eagle was seen first in early December and the latest spring record was March 25, 1947. During January, February, and early March, one or more of these eagles was seen on nearly every field trip. On March 10, 1947, one was seen perched on a dike along a rice field about 10 miles south of Inch'on and two others were in the air. Near the same place on March 16, 1947, five were seen in the

air at one time, all just sailing over the mud flats. Back from the coastal flats they were often seen perched on a dike in an open rice field or flying low along the rivers. When the rivers freeze they move down along the coast to open water. Several remained in and around Inch'on harbor nearly all winter. They often perched out on a pile of broken ice and several times I saw one pick up something from the water. These birds were very wild and difficult to approach. However, even at a distance they can not be confused with any other species, except possibly Steller's Sea Eagle when in immature plumage, but even then the immense bill of the latter is distinctive.

Haliaeetus pelagicus (Pallas). STELLER'S SEA EAGLE.—Rare winter visitor. Only two birds were identified positively as this species. Both were examined through binoculars when not over 200 yards away. The white shoulders, immense bill, and unusual size of this eagle preclude confusion with any other species. The first one seen was over a coastal marsh near the village of Sin-gil-li, south of Inch'on, on March 16, 1947. I watched it for nearly half an hour as it flew low over the duck marsh apparently looking for food. The other was on a similar coastal marsh on February 23, 1948. When first seen it was perched on a dike. After an unsuccessful attempt to stalk it, it flew on down the coastline. On three other occasions I saw dark plumaged birds which were too large to be *Haliaeetus albicilla*, but I could not identify them positively. They were possibly young Steller's Sea Eagles in immature plumage or they could have been the darker form *niger*.

Circus cyaneus cyaneus (Linnaeus). HEN HARRIER.—Rare winter visitor. Only one *Circus* was seen all the time I was in Korea. This was a female shot about 30 miles southeast of Seoul, February 23, 1948.

Pandion haliaetus haliaetus (Linnaeus). OSPREY.—Rare visitor. I saw a single osprey flying over the Imjin-Gang River just north of Munsan on October 5, 1947. I watched it through binoculars for about 20 minutes as it circled up and down over the river. It finally struck the water and came up with a fish about half the length of its body, then flew down the river.

Falco peregrinus leucogenys Brehm. SIBERIAN PEREGRINE FALCON.—An uncommon migrant and a rare summer resident on the coastal islands. Two or three large falcons were seen at different times flying over the duck marshes. No specimens were collected, but by a process of elimination these were identified as peregrines.

I have recently received from K. Kobayashi of Kobe, Japan, a set of two peregrine eggs collected by a Japanese lighthouse keeper on Shichihatsu Island, on April 2, 1937. This island is about 30 miles off the coast of Mokpo, Cholla Namdo. Mr. Kobayashi has another set of four eggs collected on the same island. I have examined carefully both sets and there is no doubt as to their identity.

Falco columbarius insignis (Clark). ASIATIC MERLIN.—Rare migrant. The only bird I identified as a Merlin was a male which I shot about six miles east of Inch'on on December 1, 1948.

Falco tinnunculus interstinctus Horsfield. JAPANESE KESTREL.—Summer resident in Kyonggi Do Province and occurs during the entire year. Those present during the winter would be expected to be *dorriesi*, the lighter colored form from northern Manchuria. However, a male which I shot east of Suwon on December 21, 1947, has been identified by Dr. Friedmann as *interstinctus*.

Although not rare, these little falcons are sly and wary around their nesting site, which probably accounts for the lack of definite breeding records. When one is several hundred yards away from an occupied nest the female will slip away unobserved, to appear in the air some distance away. Even after a pair was known to occupy an area, it required hours of watching, sometimes several days, to locate the

nest. One pair was so sly that the nest was never found, although they were continually in the same area. A positive nesting record was established only after the young had left the nest and two of them were collected.

I also found two pairs nesting within the city of Seoul. One pair had taken over an old magpie nest on Nam-San; the other nested under the eaves of a temple. I found three other pairs breeding within 10 miles of the city. One of these nested under the roof of a small temple in front of an ancient tomb, and two in old magpie nests. One of these was in the very top of a big spruce about 80 feet from the ground, and the other was about 40 feet from the ground in a pine. When an old magpie nest is used, all of the inner lining is cleaned out and the eggs are laid on the dry mud in the base of the nest.

Nesting activities begin early in April. Nearly fresh eggs were collected April 24, 1948; heavily incubated eggs were found May 8, 1948; young just hatched were found on May 16, 1948; and young birds apparently out of the nest for a week or more were collected June 16, 1948.

Tetrastes bonasia amurensis Riley. AMUR HAZEL GROUSE.—I saw a small flock of five birds January 26, 1948, in the mountains of western Kangwon Do Province.

Coturnix coturnix japonica Temminck and Schlegel. JAPANESE QUAIL.—Generally reported as quite common, but I did not find them so. A single bird flushed from the edge of a dike in a rice field south of Inch'on March 10, 1947, and a male was shot east of Suwon on December 21, 1947. Apparently their habitat is very localized, as these were the only ones I saw during my stay in Korea.

Phasianus colchicus karpowi Buturlin. KOREAN RING-NECKED PHEASANT.—Resident. Formerly abundant, but during the three years of army occupation it was greatly reduced in numbers. Not only did the thousands of soldier hunters take a heavy toll during the hunting season, but the "liberated" Koreans recognized no restrictions. They resorted to both trapping and poisoning for the market. By the fall of 1948 the pheasant had become a comparatively rare bird except in isolated localities. Numerous birds were shot, but only two skins were preserved. A male taken 12 miles northeast of Seoul on April 25, 1948, and a female shot six miles south of Seoul on April 18, 1948. Both of these were identified by Dr. Friedmann as *karpowi*. I flushed a female from a nest containing three fresh eggs on April 24, 1947.

Turnix sanka blanfordi Blyth. BURMESE BUTTON QUAIL.—A female collected about five miles northwest of Ilsan, October 30, 1948, was the only Button Quail seen. While I was tramping through a rice field en route to a goose blind, it flushed from a small clump of grass just under my feet and a lucky shot brought it down. I thought it to be a Japanese Quail until I picked it up for examination.

Gallirex cinerea (Gmelin). WATER-CK. —Summer resident and rather common around the rice fields in some localities. I found it only in or around cultivated fields. It may be that these birds arrive from the south in May, but they were neither heard nor seen until the last week in June. After early July the males are quite noisy, and their loud thumping calls are heard in the rice fields until about the first of August. Their call has been well described by Chester Fennell who wrote me of his observations near Pusan, "A far carrying call of two distinct pitches, the average performance consists of about eleven regular low pitched notes, immediately followed by 20 to 26 higher pitched, stake-striking, resonant notes, rushed at the beginning of the series and gradually petering out in tempo. The performance is continuous and is repeated several times."

A typical nest with four slightly incubated eggs was collected on July 22, 1948. This was in thick grass on a dike between two rice fields. It was well formed of grass

blades woven around standing stems which supported the nest so that the bottom was just off the ground. A characteristic feature of the nest is that the surrounding grass is pulled down and tucked in over the nest to make a well formed canopy over the eggs. The female usually will sneak off through the grass at the first sign of danger, but the pulled-over grass stems betray the location of the nest.

Fulica atra atra Linnaeus. COOT.—Uncommon summer resident and a common spring and fall migrant. Birds were seen occasionally during the summers of 1947 and 1948 in the shallow marshes along the coast between Inch'on and the mouth of the Han River. A male and a young female were collected east of Inch'on September 15, 1948.

Otis tarda dybowski Taczanowski. SIBERIAN BUSTARD.—Rare winter visitor. During January and February, 1948, bustards were seen several times in the big valley north of Susong, some 10 miles east of Seoul, and one was shot there February 10, 1948. Three were seen south of Kimpo Airport on February 21, 1948. During the winter of 1947-48, I examined two that were shot by other officers and I heard of several more that were brought in by hunting parties.

Charadrius dubius curonicus Gmelin. LITTLE RINGED PLOVER.—Summer resident and common along sandy stream beds or on open gravelly areas not too far from water. The first spring arrival was seen March 30, 1947. From early in April until July in 1947 and 1948, Little Ringed Plovers were seen on nearly every field trip. Several pairs were found nesting on an abandoned railway fill and other nesting pairs were seen along all of the wide gravelly stream beds. In general they tend to associate in scattered colonies, as several pairs were usually found in the same area. The nest is only a slight depression in the sand or among small stones, and the eggs look so much like small pebbles that they can hardly be recognized even though one is looking directly at them. Young two or three days old were seen May 29, 1948, and fresh eggs were collected on May 30, 1948.

Numenius phaeopus variegatus (Scopoli). EASTERN WHIMBREL.—Rather common migrant in the spring but was not seen in the fall. On two different occasions Whimbrels were found in scattered flocks feeding in open woodlands. This to me was most unusual, as previously I had only seen them along the sandy beaches or on open grassland. One bird was shot near the beach south of Inch'on, April 25, 1947, and another in a wooded valley north of Kimpo, May 5, 1947.

Tringa nebularia (Gunnerus). GREENSHANK.—A common fall migrant, it was not seen in the spring. During October and November in both 1947 and 1948 several flocks were seen along the coastal flats about 25 miles south of Inch'on. One was shot from a flock of about 10 birds on November 3, 1948.

Heteroscelus incanus brevipes (Vieillot). ASIATIC WANDERING TATTLER.—The only bird identified as this species was a female shot May 18, 1947. This was a lone bird first observed feeding along a stony stream bed south of Anyang. Austin writes "... uncommon transient on the east coast, and practically unknown elsewhere in Korea."

Capella stenura (Bonaparte). PINTAIL SNIPE.—Common spring and fall migrant. Many were seen in the rice fields in April, and in late September they were present in sufficient numbers to afford good shooting.

Larus canus kamtschatschensis (Bonaparte). ASIATIC COMMON GULL.—Common winter resident all along the west coast. Gulls were abundant in Inch'on harbor from early September until mid April but this was the most common species and the only one that was identified positively.

Sterna albifrons sinensis Gmelin. ASIATIC LITTLE TERN.—Not uncommon summer resident. Occurs principally on the sand bars at the mouth of the Han River or on the wide sandy beaches along the river. First seen near the coast south of Inch'on, May 25, 1947. Several terns were seen along the Han River about 10 miles east of Seoul on May 30, 1948. These were probably nesting or ready to nest, as they were very noisy and excited when I walked across a wide sandy beach. Another colony of about 20 pairs was found on a wide sandy beach on the Han River northwest of Seoul on June 5, 1948. Eight occupied nests with eggs were found and three sets of eggs were collected. All nests observed contained only two eggs each and not four eggs as reported by Won.

Columba livia rupestris Pallas. BLUE HILL PIGEON.—Rare summer resident. A few probably remain all winter, as I saw a flock of six about 40 miles east of Seoul on January 24, 1948. This pigeon is an inhabitant of the wilder mountains and can easily be overlooked. It is apparently either much rarer now than in former years, or it has a very local distribution. During the fall hunting seasons of 1947 and 1948, I examined many "wild pigeons" brought in by hunting parties but all proved to be Turtle Doves. A few individual birds were seen at a distance during May, 1948, and on June 5, 1948, three or four pairs were found nesting on a rocky ledge at the top of a narrow valley in the mountains northeast of Suwon. One nest with two incubated eggs was collected. This was on a narrow shelf about 40 feet from the base of a 60-foot cliff and well protected from above by an overhanging ledge; two other nests were near.

Streptopelia orientalis orientalis (Latham). EASTERN TURTLE DOVE.—Common resident and abundant in some localities during migration. Mating pairs were frequently seen from mid April until July. The earliest nest with eggs was seen May 3, 1947, and the latest record for eggs was a set of two collected July 25, 1948. Possibly two or more broods are raised in a season.

Cuculus canorus telephonus Heine. JAPANESE CUCKOO.—Common during the summer and presumably breeds. Birds were first seen May 16, 1947, and on May 15, 1948. All through May and June, cuckoos were seen or heard during every field trip but no eggs were found.

Otus asio ussuriensis (Buturlin). FEATHER-TOED SCOPS OWL.—The only Scops Owl seen was a male collected February 28, 1948, about eight miles northwest of Seoul. This bird was flushed from a magpie nest in open pine woods in the rolling foothills.

Bubo bubo tenuipes Clark. CLARK'S EAGLE OWL.—Rare resident. I saw no Eagle Owls during the time that I was in Korea, but they were reported by several different officers, one telling me that he had seen a nest with young on a rocky ledge near the Han River east of Seoul. My hunter-guide, Kim Hun Suc, offered to take me to a nest in the Chinjim-Myon area about 40 miles northeast of Seoul but bad roads prevented the trip. He did bring me a fresh skin that was taken near Chunchon on November 30, 1948.

Ninox scutulata scutulata (Raffles). BROWN HAWK-OWL.—Summer resident and apparently rather common, as a pair were found in nearly every patch of heavy woods. First observed April 18, 1948, when a male was collected. This bird had enlarged testes and I assumed that it was either breeding or about ready to breed. During the following days many hours were spent trying to trace other owls to their nests, but without success. Afterward it was discovered that the nesting habits of this species are rather unusual in that they do not begin until late in May. After many unsuccessful attempts to find a nest, on May 31, 1948, a bird was finally found

in a small woods, which indicated by its actions that a nest was undoubtedly near by as it would only fly from tree to tree and would not leave the area. After hours of search the female was at last flushed from an old magpie nest about 75 feet up in the top of a big pine. Investigation disclosed that the top of the magpie nest was partly gone, all the inner lining had been removed, and two nearly fresh eggs were resting on the dry mud base of the old nest.

During the following week two other nests were located in old magpie nests and on June 6, 1948, a nest was found about 20 feet from the ground in a big natural cavity of an old stub. As with the other nests, there was no lining or nesting material, the eggs merely resting on bits of decayed wood and debris on the bottom of the cavity. Other Hawk-owls were later found in the vicinity of several different temples. They were presumed to be nesting in some hole or cornice of the building, but no eggs nor young were found to prove it. In the defense of its nest, this owl is very much of a battler and will not hesitate to attack the intruder with both bill and talons.

Strix aluco ma (Clark). KOREAN WOOD OWL.—Not uncommon resident. I saw single birds several times during field trips through the mountains north and east of Seoul in April, 1948, and after detailed searching located the home territories of two different pairs. They were in different valleys, but each occupied a comparatively small area of thick spruce trees. In both cases I was sure that the birds were breeding, but hours of careful search failed to disclose anything that could have been used for a nest. On May 19, 1948, after it was too late in the season for either eggs or nestlings, two more Wood Owls were found in a similar thick growth of spruce about 15 miles north of Seoul. Both were collected and subsequent examination indicated that although they were fully grown, they were probably young of the year. I collected a third specimen, an adult male in the Kings Tombs area northwest of Seoul on May 22, 1948. In the summer of 1949, Kim Hun Suc sent me a set of two eggs he had collected from an open stick nest in thick pine woods in eastern Kyonggi Do Province February 15, 1949.

Asio flammeus flammeus (Pontoppidan). SHORT-EARED OWL.—Spring and fall migrant. In the late evening of March 17, 1948, I shot a male flying over a marsh about 24 miles northwest of Seoul. This owl is apparently more common than available records indicate. Many times during both early spring and fall I flushed owls along the roadway while driving at night. These birds were only seen along a road in an open valley or one that was bordered by rice fields. While they could not be seen clearly, their size and long wings immediately identified them as Short-eared Owls.

Alcedo atthis bengalensis Gmelin. COMMON INDIAN KINGFISHER.—Common summer resident. Seen frequently in all of the valleys and along the streams in the foothills. They arrive in the vicinity of Seoul about the second week of April and were last seen in early August. I found a pair excavating a nesting hole in a low dirt bank about four miles southeast of Inch'on on April 26, 1947. Apparently both the male and female dig together as the two alternate going in and out of the hole and sometimes both were in it at the same time. Numerous nests were found, always in clay banks, some in cuts not over 18 or 20 inches high along a roadway. The nesting hole is about two and a half inches in diameter and usually goes back from 12 to 30 inches. At the end, a rounded chamber with a slight depression holds the eggs. Two or more broods may be raised each year as fresh eggs were found early in May and a set of six well incubated eggs were collected northwest of Seoul July 13, 1948.

Halcyon coromanda major (Temminck and Schlegel). JAPANESE RUDDY KINGFISHER.—My only record of this species is a male secured in the Seoul market September 24, 1948.

Halcyon pileata (Boddaert). BLACK-CAPPED KINGFISHER.—Uncommon summer resident. This kingfisher is most frequently found in narrow valleys bordered by steep gulches. Two nests were found, both in similar locations. They were approximately half a mile back from the stream in the clay bank of a narrow eroded gulch. The nesting hole dug by the birds is about four inches in diameter and goes back two or three feet. Fresh eggs were collected June 10, 1948, and young about two-thirds grown were found July 18, 1948.

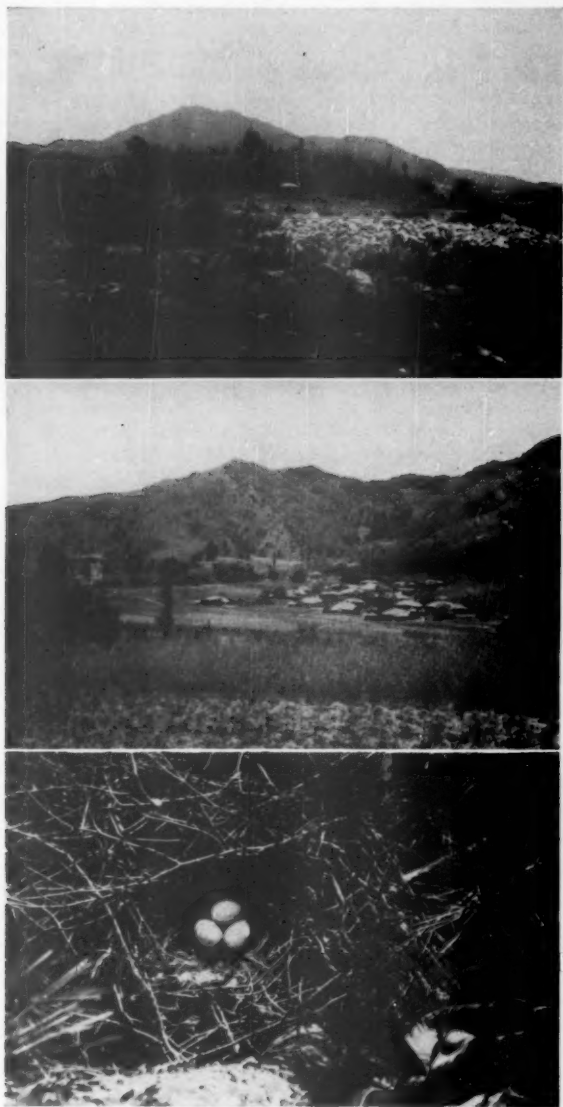
Eurystomus orientalis abundus Ripley. BROAD-BILLED ROLLER.—Not uncommon summer resident. A pair was usually to be found inhabiting the tall trees which surround many of the ancient Korean tombs. Mating pairs were first seen May 12, 1947, in a tomb area about six miles northwest of Seoul. During the mating period and again about the time the young are leaving the nest, these birds are very noisy and much in evidence flying from tree to tree and repeating their harsh guttural calls. After the young are grown, the family remains in the vicinity of its nest until departing for the south in August. These birds make no nest. Most frequently a deserted magpie nest is used, but one was found in a natural cavity of a big tree, and another in a deserted hole made by a Tristram's Woodpecker. Two different pairs were seen at old temples, apparently nesting under the roof as birds were seen to go in and come out of woodpecker holes under the eaves. The usual nesting period begins about the first of June. A bird was flushed from a hole May 23, 1948, but no eggs had been laid. Fresh eggs were collected June 2, 1948, west of Munsan, and another set was taken east of Seoul, July 16, 1948. The latter was probably a second nesting. Two or three eggs constitute a full set.

Upupa epops saturata Lonnberg. TIBETAN HOOPOE.—Rare summer resident. Birds were seen around several of the ancient tombs from the last week in April until mid July. They were always wary and difficult to approach, but I am sure that they were nesting. No nests were found, perhaps because I was always more interested in some other species and did not take the time to hunt for them.

Picus canus jessoensis Stejneger. KOREAN GREEN WOODPECKER.—Not uncommon summer resident, a few remain during most of the winter as I shot one northwest of Seoul on November 23, 1947. Spring migrants were seen early in April and birds were observed frequently in open woodlands during the entire summer. A female was shot April 25, 1948, just as she left her nesting hole in a dead stub about seven feet from the ground. The nest contained four fresh eggs and another soft shelled egg was in her oviduct. A male collected May 22, 1948, was one of a nesting pair. The female was flushed from a hole about 12 feet up in a partly dead stub, but the nest was not disturbed as I presumed that it contained young birds. Other Green Woodpeckers were collected June 5, 1948, and October 31, 1948. As noted by Austin, the habits of this species are similar to those of the American Flicker (*Colaptes*), especially in regard to feeding on or near the ground, the selection of a nesting site, and their general habitat.

Dendrocopos major japonicus (Seeborn). JAPANESE PIED WOODPECKER.—Not uncommon resident throughout the year. Birds were collected January 18, April 11, and November 20, 1948. I saw a pair on May 5, 1948, that were apparently mating and the actions of a male seen on May 23, 1948, indicated a nearby nest. While no eggs were collected, there seems to be little reason to doubt that the Pied Woodpecker breeds in Kyonggi Do Province.

Dendrocopos canicapillus doerriesi (Hargitt). MANCHURIAN PYGMY WOODPECKER.—Not uncommon summer resident in suitable localities. This is a bird of the open woodlands and is most frequently found at low elevations and near a stream



(Top) NESTING GROUNDS OF *Accipiter soloensis*—IN TREES BEHIND HOUSE. (Middle) NESTING GROUNDS OF *Accipiter soloensis*—IN TREES TO RIGHT OF VILLAGE. (Bottom) NEST AND EGGS OF *Butastur indicus*.



or in a swampy area covered with medium-sized timber. It was never seen in heavy forest. The first spring arrivals were seen in early April. Both males and females were seen on April 11, 1948, and a female with enlarged ovaries was shot on April 18, 1948. In a small swampy woods about 12 miles northwest of Seoul on May 16, 1948, I flushed a female from a nesting hole about 15 feet from the ground in a small partly dead water oak. This nest contained three fresh eggs. During May and June I saw other breeding pairs but no nests were examined.

Dryocopus martius martius (Linnaeus). GREAT BLACK WOODPECKER.—Rare resident. This species is found only in the wilder areas of heavy forest. I saw a male about 35 miles northeast of Seoul on November 6, 1948, and shot an adult female east of Chun-Chon on November 30, 1948. The species undoubtedly breeds in northeastern Kyonggi Do Province, but as the large trees are being rapidly cut off these birds are being forced to move to the uninhabited areas farther north.

Dryocopus richardsi Tristram. TRISTRAM'S WOODPECKER.—This huge woodpecker has been reported as very rare and on the verge of extinction, but I was fortunate enough to find three breeding pairs. Two of these pairs were in separate areas northwest of Seoul and the other was in a hidden valley of giant spruce trees northeast of Seoul. Each pair occupied a restricted zone of large timber adjacent to an ancient Korean tomb where the trees had been protected for hundreds of years. Both the male and female birds were seen in each area, but the males were especially wary and difficult to observe. Each territory contained several nesting holes, some old and partly broken, others of more recent vintage, and one or two that appeared to be in use. Likewise there were numerous trees which had been worked over and other evidence to indicate that each area had been occupied by a pair for several seasons. In addition to these three pairs, an adult male with a brilliant red crest was seen in an open pine woods west of Kumch'on-ni on October 31, 1948.

A young male just able to fly was shot May 31, 1948, just as he left a nesting hole which from its appearance had been used to raise the season's brood. Calculating backward from this date, eggs must have been laid in early April and not in May and June as quoted by Austin from Mori's account of this species.

Alauda arvensis quelpartae Momiyama. KOREAN SKYLARK.—Common summer resident, and a few may possibly remain all winter. Three skins taken in January, however, were identified by Dr. Friedmann as the larger northern form, *Alauda arvensis pekinensis*. Skylarks are very common during the entire year, but it is impossible to make field identification of the different races. Males were in full song by mid April, and fresh eggs were found from the last week of April until the second week of June. Well feathered young were found on May 12, 1948, and young a week or more out of the nest and fresh eggs were collected May 31, 1948; hence two or possibly three broods are raised each season.

Galerida cristata coreensis Taczanowski. KOREAN CRESTED LARK.—Very common summer resident and some probably remain all winter. In the field this species flocks with the skylarks all winter, and the two are so easily confused that unless birds are collected constantly it is difficult to determine the winter status of either one. Nesting begins in early April and two or more broods may be raised. Young of the year but several weeks out of the nest were collected May 30, 1948, and a nest with eggs was found the same day. Fresh eggs were collected as late as June 26, 1948.

Hirundo rustica gutturalis Scopoli. EASTERN HOUSE SWALLOW.—Abundant summer resident. The swallows top the list of the few common birds in Korea, but unlike the others they are welcomed in the home and are considered a token of good luck. They are abundant around all of the villages and nest undisturbed almost

within the cramped living quarters of the Koreans. I often noticed nests under a sheltered doorway or under the eaves of a porch where the entire family passed back and forth all day without disturbing the birds.

The earliest spring arrivals were observed April 13, 1947, and by the 20th they were common. Nest building began about the last week in May and fresh eggs were found June 10, 1948. By mid September the majority had moved southward again, but a few stragglers were seen as late as October 5, 1948.

Hirundo daurica japonica Temminck and Schlegel. JAPANESE MOSQUE SWALLOW.—A common spring and fall migrant, but I found no sign of its nesting in Kyonggi Do Province. Along with the House Swallows, this species was seen frequently on the telephone wires from early April until mid May. Apparently they moved northward to their summer breeding area, and I did not see them again until the southward flight began in August.

Delichon urbica dasypus (Bonaparte). JAPANESE HOUSE MARTIN.—Rare summer resident. My only record was of a small colony nesting near the river about 40 miles northeast of Seoul. While investigating a series of low cliffs on the north fork of the Han River near the village of Kuam-ni on June 5, 1948, I noticed 15 or more martins around one ledge. Further search disclosed an area perhaps 50 yards long where a stratum of soft shale was topped with a layer of hard rock which had not weathered away as fast as the under stratum, making a nearly flat roofed shelter some 30 feet high and five or six feet deep. Plastered against the back wall and close to the ceiling were five completed mud nests and two others partly completed. It was impossible to determine whether the latter were abandoned attempts at nest building or new ones being constructed. After some difficulty in securing a three-pronged branch and splicing poles, one nest was eventually brought down without mishap. It contained four nearly fresh eggs.

At the time it was not realized that this would prove to be an unusual breeding record, so no skins were collected. However the size, color, and shell texture of the eggs are sufficiently distinctive for identification.

Oriolus chinensis diffusus Sharpe. BLACK-NAPED ORIOLE.—Not uncommon summer resident. The earliest arrival was a male seen near Seoul, May 8, 1948. Between the 12th and 15th of May, mating pairs were frequently seen both in and around Seoul. During this period the males are very noisy and their loud mewing "cat calls" can be heard in nearly every patch of trees, although the birds are wild and difficult to see. The normal habitat of this species is a rather thick growth of medium-sized deciduous timber, usually in an isolated valley where they are not disturbed. Orioles were never seen in the higher mountains. A brooding female with nest and three eggs was collected north of Inch'on on June 1, 1947, and a nest just ready for eggs was found northwest of Seoul on May 31, 1948.

Corvus corone orientalis Eversmann. EASTERN CARRION CROW.—Crows were seen nearly everywhere in Korea during the entire year. The two resident species are difficult to identify except upon close inspection. As they often feed and flock together during the winter, it is a problem to determine the approximate local population of either form, especially as a large number of migrants from the north mingle with the local birds during the entire winter. In the Seoul area the Carrion Crow is more common during summer, and the Jungle Crow more abundant during winter, but the latter birds scatter to the hills or move northward in early spring. In winter both species intermingle during the day and fight over the same garbage piles, but in late afternoon they separate, each species going to its own rookery. In general Carrion Crows roost in trees around a town or village and the Jungle Crows back in

the hills. This conclusion was reached after watching hundreds going to the different roosting places and was confirmed when continuous evening shooting at several rookeries in and around Seoul did not net a single Jungle Crow. On the other hand, only Jungle Crows were secured during two evening shoots at different rookeries back in the mountains. Similarly, the nesting habitat and summer range of the Carrion Crow are the open valleys and low foothills, while the Jungle Crow spends the summer back in the mountains.

In early March the large winter flocks begin to separate, and the mated pairs scatter out in the valleys to begin their housekeeping. The characteristic nesting site of the Carrion Crow is tall poplars along the stream beds and dikes of the low country. At least 15 or perhaps more occupied nests were examined during 1947 and 1948, only two of which were in pine trees. Both of these, however, were in small pines at the edge of a rice field. Although some pairs nest earlier, normally the eggs are laid and incubation starts about the first week in April. One set of four eggs was collected March 28, 1948; another set of four was collected April 13, 1947; and a set of seven eggs was taken April 14, 1948. Young birds several days out of the nest were shot on May 22, 1948.

Corvus leuillanti mandchuricus Buturlin. MANCHURIAN JUNGLE CROW.—Permanent resident. Contrary to the experience of Dr. Austin, I found this species very common around the trash piles in the outskirts of Seoul and along the Han River from November until the last of February or early in March. Upon the approach of spring the winter visitors migrate northward, and resident birds pair and move back to the wooded hills and mountains. The nesting habits of this species are quite different from those of the Carrion Crow. All nests observed were well back in the hills in pine or spruce trees. Their nests are larger and more bulky than those of the Carrion Crow and are always lined with a filthy mass of dirty hair and feathers. While the eggs of the two species are similar, those of the Jungle Crow average larger and much darker in color. Nesting records in the area east and northeast of Seoul are as follows: three fresh eggs, March 28; four eggs slightly incubated, April 1; five eggs nearly ready to hatch, April 18; two nests with young birds, April 18; four eggs nearly fresh, April 28; and young able to fly, May 19.

Corvus frugilegus pastinator Gould. EASTERN ROOK.—Very common spring and fall migrant, but a few may remain all winter. A female was shot about 15 miles northeast of Seoul January 4, 1948, and several were seen near the Kimpo Airport in early February. During both the spring and fall migration, Rooks were often seen in huge flocks estimated at several hundred birds. On two or three occasions flocks were seen very high in the air, just milling around in wide circles and gradually drifting southward. Spring flocks were most common in mid March and early April, and the fall migration was first observed in October.

Corvus monedula dauuricus Pallas. DAURIAN JACKDAW.—Recorded by Austin as a common winter visitor, but my observations were limited to a few birds seen with flocks of Rooks on February 21, 1948, and a single male shot February 23, 1948, while he was feeding in a rice paddy with a flock of Magpies.

Pica pica japonica Temminck and Schlegel. KOREAN MAGPIE.—Abundant permanent resident. The magpie is the most prominent bird in Korea. Magpies are most common in the valleys and around the low hills, but they are also seen frequently in the higher mountains. Their large bulky nests remain in a tree year after year, even though they may not be used; consequently, they can be seen everywhere in the single poplars all over the low country. Normally the birds prefer to nest at some distance from human habitations, but where suitable trees are not available a nest is

occasionally built right in the dooryard of a Korean home. My first observation of the mating season was March 10, 1947, when a pair was seen carrying sticks for the repair of an old nest. Nest building or repairing may continue for a month or more before the eggs are laid in the latter part of March or early in April. Only a single brood is attempted unless the first nest is destroyed, but fresh eggs may be found as late as the second week of May. My nesting records are as follows: five fresh eggs, April 11; six eggs ready to hatch, April 14; six incubated eggs, April 27; five incubated eggs, May 11; and young birds just out of the nest, May 15.

Cyanopica cyanus koreensis Yamashina. KOREAN BLUE MAGPIE.—A rare summer resident in Kyonggi Do Province. These birds were never seen in flocks and my observations were limited to two pairs. In the Kings Tombs area northeast of Seoul, May 23, 1948, two birds were seen repeatedly carrying something to a nest about 40 feet up in the very top of a slim pine growing in an open valley. It was presumed that they were feeding young, but examination of the nest disclosed that it was not yet completed; the birds must have been carrying nest materials. Our disturbance caused them to desert the nest. My next experience with the Blue Magpie was on June 20, 1948, when a female was flushed from a nest containing seven slightly incubated eggs. The female, nest, and eggs were collected. This nest was in a narrow valley in the mountains north of Masuk, about 28 miles northwest of Seoul. It was about 21 feet from the ground, saddled in the fork of a horizontal branch of a small chestnut in a thin fringe of trees near a village. The outer framework consisted of twigs and pieces of grass surrounding an inner, compactly built nest of moss and hair lined with hair, wool, and a few feathers. The general appearance of this nest and its location were similar to that of the American Blue Jay (*Cyanocitta*), and the eggs can not with certainty be distinguished from those of that species.

Corvus glandarius brandtii Eversmann. BRANDT'S JAY.—This jay was seen on only two occasions. A small group of three or four birds was seen in the hills west of Anyang on March 15, 1947, and a male was shot on the upper slopes of Chonma-San, northeast of Seoul, on April 6, 1948.

Suthora webbiana fulvicauda Campbell. KOREAN CROW TIT.—Rather common winter resident and may breed, as birds were seen occasionally in May and June. Crow Tits are very common from December until early in March and are normally seen in small flocks on or near the ground in patches of underbrush. Individual birds are constantly on the move and the flocks never remain in the same place for more than a few minutes.

Parus major wladivostokensis Kleinschmidt. GREAT TIT.—Rather common permanent resident and seen during all months of the year. During winter they were most often in small flocks trooping through the open pine woods, but in spring and summer only single birds or pairs were seen. A nest with three fresh eggs was collected May 26, 1948, about 20 miles east of Seoul. It was about five feet up in a natural cavity in a small pine. Another nest with young was found in a similar location June 4, 1948.

Parus varius varius Temminck and Schlegel. VARIED TIT.—Rare summer resident and probably present during the entire year. A nest and four fresh eggs were collected in the mountains west of Uijongbu, on June 6, 1948. They were in an old woodpecker hole about seven feet from the ground and were discovered when a bird flushed out of the hole.

Aegithalos caudatus magnus (Clark). KOREAN LONG-TAILED TIT.—Rare summer resident but common during the winter. A nest with an incomplete set of four fresh

eggs was collected about 20 miles east of Seoul, on June 3, 1948. This nest was about six feet from the ground in a small tree in a rather thick clump of small pines. It was saddled against the upright main trunk in a crotch between two small upright sprouts. The bird flushed right in front of my face, but the nest looked so much like the moss covered bark of the tree that it was not easily seen.

Troglodytes troglodytes peninsulæ (Clark). KOREAN WREN.—An uncommon winter visitor. On several occasions during the winter months a solitary wren was seen to dart out from under an overhanging stream bank or grass covered ditch, fly along the ground for a few yards, and then abruptly dive under cover beneath a bunch of grass or overhanging roots. Never was more than a single bird seen at any one time.

Turdus naumanni naumanni Temminck. DUSKY THRUSH.—Common winter resident and very common during both spring and fall migrations. During migration many flocks were seen that numbered 50 or more, but from November until about the first week of April the birds were found in small groups of from three to eight, feeding in open woods.

Phoenicurus aureus aureus (Pallas). DAURIAN REDSTART.—Rather common winter resident. Not observed later than the last week of March. This species was usually seen in a thicket or bushes adjacent to an area of larger timber. It is always on the move and is difficult to observe.

Muscicapula narcissina zanthopygia (Hay). NARCISSUS FLYCATCHER.—Not uncommon summer resident. Birds were not seen until about the middle of May when they were found nesting. A nest with four fresh eggs was found in a hole in a small rocky ledge on May 15, 1948. Another nest with young a few days old was found May 23, 1948, when a bird flushed from a small hole in a partly dead pine. The entrance hole to this nest was about five feet from the ground, and the nest was 10 inches below the entrance. On May 28, 1948, birds were seen carrying food in and coming out of a cavity six feet up in a chestnut.

Motacilla alba leucopsis Gould. WHITE-FACED WAGTAIL.—Common summer resident; a few were seen as late as early December. This species is one of the earliest arrivals in the spring. Birds were first seen in early March while the fields were still covered with ice; by the last of March they were comparatively common along the roadsides. Many of those seen in early spring move northward, but nesting pairs can be found nearly all summer. From the number of young birds that were seen in May and June, it may be concluded that more than one brood is raised; but occupied nests were only found during a period of about three weeks. A nest with five nearly fresh eggs was taken from a hole in an old stone building May 16, 1948, and another with four eggs was collected from under a small bridge June 3, 1948. A nest with six incubated eggs was found in a slight depression beneath a small pile of flat stones in a stream bed June 6, 1948. The location of this nest was completely unexpected, and it never would have been found if the bird had not flushed from under my feet.

Lanius cristatus lucionensis Linnaeus. RED-TAILED SHRIKE.—Rather common summer resident. It arrives in the Seoul area during the first week of May and mating pairs are seen shortly thereafter. This shrike is most often found around small patches of pines on the low hills, preferably adjacent to open rice fields, where it is seen perched on a prominent lookout watching for food. During the mating period and when the young are in the nest, both birds are noisy and seldom hesitate to pick a fight with any feathered intruder that comes near. Even at the approach of a man they do a great deal of scolding. The nest is usually situated from 15 to

30 feet from the ground and well toward the top of a small pine. A typical nest with six eggs collected May 30, 1947, was in the top of a small pine on the brow of a hill. It was comparatively large for the size of the bird, quite bulky, and composed of grass, bits of moss, pieces of cotton, and bits of paper. These were all woven together and then well lined with rootlets and a few hairs. Eggs or nests with young were observed several times between May 25 and June 16, 1948.

Spodiopsar cineracea (Temminck). GREY STARLING.—A common spring and fall migrant; a few pairs remain to breed, at least in the Seoul area. Three or four pairs of Grey Starlings were first seen when they were examining some natural cavities in two large trees in the Change Duc Palace grounds on April 14, 1948. These birds were seen several different times until the end of May, and I am sure that they raised young there. At the time I thought that central Korea was well within their normal breeding range and consequently did not take time to investigate their nesting holes.

Passer montanus dybowskii Domaniewski. USSURIAN TREE SPARROW.—Abundant permanent resident. Along with the magpies, herons, crows and swallows, the Tree Sparrows constitute the common bird population of Korea. During late summer and early fall they congregate in large flocks around the rice fields and do considerable damage to the ripening grain. As a protective measure to keep them away, the Koreans frequently erect many poles around the field, to which are attached long paper streamers, pieces of cloth or strings of tin cans so that they will move in the breeze. Sometimes small ropes with streamers attached are tied clothesline fashion from one pole to another; a long cord extends from a center pole to a corner of the field. Here a watcher sits motionless for the entire day, only pulling the cord to rattle the cans and wave the streamers when a flock of sparrows appears.

Nesting begins early in April and continues until mid June; two or more broods are raised each season. All of the nests I saw were either in the cornice of a building or under the edge of a roof. They were always a bulky mass of grass, bits of paper, and pieces of trash with an inner lining of feathers. The number of eggs in a set varies from three to seven, but usually there are four or five.

Euphonia migratoria migratoria Hartert. CHINESE GROSBEAK.—Not uncommon summer resident. It arrives from the south in early May and the latest birds were seen July 26, 1947. A mating pair was seen May 5, 1947, about 15 miles north of Inch'on, and several other pairs were seen north of Seoul on May 12. A nest just ready for eggs was found May 25, 1947, about five miles east of Inch'on, and a set of three eggs was collected 12 miles northwest of Seoul on May 31, 1948. Both of these nests were in the very top of spruce trees about 35 feet high.

Chloris sinica ussuriensis Hartert. USSURIAN GREEN FINCH.—Very common winter resident, but none were seen after the first week of April. During late winter and early spring, numerous small flocks were seen in low shrubbery or in patches of brush in every sheltered valley.

Fringilla montifringilla Linnaeus. BRAMBLING.—Rather common spring and fall migrant; a few remain all winter. The earliest fall record was on September 14, 1948, when birds were found in the Seoul market.

Emberiza rutila Pallas. CHESTNUT BUNTING.—Rare migrant. This species was seen only in small flocks, or single birds were seen in company with other species of buntings.

Emberiza cioides castaneiceps Moore. MEADOW BUNTING.—Very common winter resident and a rare summer resident; birds were seen in every month of the year. During winter they were found commonly in open country or seen perched in low

trees along the roadside. In late March wintering flocks move out and the few pairs which remain to nest are inconspicuous on the brushy hillsides. Dr. Austin mentions the arrival of *castaneiceps* in April. However, three birds which I shot in January have been identified by Dr. Friedmann as this race, so apparently both forms occur all winter. On May 20, 1948, a Meadow Bunting was flushed from a nest containing one egg. It was on the ground in rather thick grass near the edge of a thicket. Both parents were near by and appeared to be quite concerned. However, when I returned to the nest on the 26th it was deserted and the birds could not be found. The egg is now in my collection.

Emberiza fucata fucata Pallas. GREY-HEADED BUNTING.—Not uncommon summer resident. These buntings arrived from the south in mid April and were seen commonly for two or three weeks. Then they disappeared, and it was concluded they were only migrants until a pair was found on May 25, 1948. While driving from Sosa to Shinsen two birds were seen near the road where it crosses the high ridge between the two villages. Subsequent search over the bare hills east of Inch'on and on the slopes of Pup-Yong, west of Kimpo, revealed the summer habitat of this sparrow to be in the grass and brushy ravines around the summit of these treeless hills. Several breeding pairs were found and young birds were later seen, but no nests were found. There were two or three pairs around the top of every hill, and the males were in full song until the second week of July.

Emberiza rustica rustica Pallas. RUSTIC BUNTING.—Common winter visitor from the last of November until about the first week of April. It was seen in small flocks or mixed with small flocks of Meadow Buntings.

Headquarters, 8th U. S. Army, Yokohama, Japan, March 15, 1950.

CONDITIONED RESPONSES IN CROWS

BY A. O. RAMSAY

THE following experiments were designed to determine the rôle of traditions in the well-known mobbing behavior of the Common Crow, *Corvus brachyrhynchos*, toward owls.

The extensive literature on enemy recognition in birds has been reviewed by Nice (1943) and need not be reviewed here. It is sufficient to note that since the experiments of Thorndyke (1899) some students have held to the position that the inherent fear responses of birds are generalized. Others, such as Lashley (1938), have taken the position that just as birds have an innate perceptory pattern of the nest characteristic of the species so they may also have an inherent pattern of certain enemies. Lorenz (1935) found that his Jackdaws, *Corvus monedula*, had to learn what to fear from their parents or from other members of the social group. Nice and ter Pelkwyk (1941) reported that Song Sparrows, *Melospiza melodia*, showed moderate alarm at all the mounted birds used, including Hornbills, *Bucerotidae*, and Grouse, *Bonasa umbellus*, and strong alarm at the Barred Owl, *Strix varia*. They also found that Song Sparrows had to learn to recognize cats and Cowbirds, *Molothrus ater*, as enemies. Rand (1941) found that his hand-reared Thrashers, *Toxostoma curvirostre*, regarded owls as objects of curiosity until they moved. From such extensive experiments Rand (1942) was led to suggest that mobbing behavior represents a conflict between two opposing tendencies: the tendency to flee (fear) and the tendency to approach (curiosity). Lack (1941) made essentially the same suggestion with the exception that he emphasized the tendency to attack as one of the conflicting impulses.

ACKNOWLEDGMENTS

The experiment to be described was inaugurated through contact with Dr. John E. Cushing. I am indebted to Mrs. M. M. Nice and Dr. David E. Davis for suggestions and criticism. The accompanying photograph was taken by Mr. Robert C. White of the McDonogh School, Maryland.

The object of this experiment was to determine the extent to which the behavior of the two species studied might be modified. In this experiment two crows were taken from their nest and reared by hand. Crow A, which was the most precocious of the brood, was taken when only a week old. Crow B, which was the least precocious of the lot, was taken a week later. These crows were kept in a bushel basket



CROW BEGGING FOOD FROM BARRED OWL

beneath mounted specimens of a Barred Owl, *Strix varia*, and a Cooper's Hawk, *Accipiter cooperii*. When they left this improvised nest at the age of approximately five weeks they were placed in a pen with a live owl that was approximately eight weeks old. When the two species were placed together neither showed any noticeable alarm and two days later they were all found to have taken refuge from the rain in the same box. They usually roosted a foot or more apart and not immediately beside each other. The only type of aggressive action that was observed in this stage of the experiment was first noticed when the two species were settling down for the night. On this occasion, Crow A perched immediately beside the owl first on one side and then on the other, meanwhile walking up and down and jumping back and forth over the owl. At this time the two species had been together for three weeks. This more restless activity also resulted in attacks by the owl on other occasions when the crows approached closely.

When the two species had been together for one week, Crow A was observed begging food from the owl—opening his mouth, quivering his wings and calling (Plate 14). He persisted in this behavior for three days and at intervals thereafter for 3.5 weeks. As the owl at this time was being force-fed ground horse meat and as the crow had previously been observed pecking scraps of food from around his mouth, this begging behavior does not necessarily mean that the crow mistook the owl for its parent. Later experiments indicated that this response might be evoked by the sight of food alone. It would seem to be, however, a clear example of what Lorenz (1935) terms instinct interlacement, that is, the behavior here is clearly composed of an inherent motor element directed at an acquired object.

Both crows developed a difference in response to different foods. By the time he was eight weeks old, Crow A would not eat bread and would rarely beg at the sight of it, though, at the same time, he would beg at the sight of meat. Both crows would continue to beg for meat, even when satiated, and hide it in crevices about their pen. Sometimes they would cover it with a bit of paper or feather. These responses continued for the three months of the experiment.

When the two species had been together for 51 days, the owl was moved temporarily to another pen. During this interval the reaction of the crows toward mounted specimens of seven species of hawks and owls was determined. The mounted birds were attached one at a time to the crows' favorite roost and left for intervals of one hour. Both crows at first showed marked alarm at the presence of the mounts, screaming when they were brought into the pen, panting, and flying to

the other end of the pen. By the third test it was noticed that Crow A, but not Crow B, could be enticed immediately beside the mounts with food, and by the seventh test neither crow showed alarm at the presence of any of the mounted specimens including species that they had previously avoided. They would frequently alight immediately beside the mounts and sometimes probe gently at their feathers. This exploratory pecking indicates that they regarded the mounts as objects of curiosity and not as indifferent objects.

These tests occupied 17 days. Immediately thereafter the live owl was returned to the pen for 90 minutes. Both crows immediately flew beside the owl, quivering their wings and calling loudly. They persisted in this behavior during the entire period in spite of the fact that the owl took up several positions in the pen and snapped at them repeatedly. It was not observed what released this behavior on the part of the crows. This behavior represented the closest approach to mobbing behavior ever observed but here it was greatly modified. The wing quivering of the crows toward the owl might seem to indicate that they had learned to accept the owl as the socially dominant species. All fear of the owl had been removed by the conditions of the experiment. It is also interesting to note that none of the wild crows in the neighborhood responded to these calls.

Two months later the behavior of the crows toward various species of predatory birds was tested as before and with similar results. The crows would frequently light beside the mounted birds and sometimes peck at their feathers. Immediately thereafter the owl was returned to the pen with the crows where he remains to this date.

SUMMARY

Two crows were reared with a Barred Owl. Neither species showed any alarm at the presence of the other, and one crow begged food from the owl for three days and at intervals thereafter for 3.5 weeks. The activity of the crows released pecking behavior by the owl when the crows approached too closely, especially when they were calling simultaneously. After the two species had been together for 51 days, both crows showed alarm at the presence of mounted specimens of seven species of raptorial birds as shown in consecutive tests. They learned not to fear these mounts, and two months later this response remained unchanged.

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THE GROWTH OF STARLING, *STURNUS VULGARIS*,
POPULATIONS

BY DAVID E. DAVIS

INTRODUCTION

BECAUSE of the newness of the studies of bird populations, considerable confusion exists concerning the theory and data relating to increases in numbers. This paper attempts to clarify at least certain aspects and to stimulate studies of bird populations. First the theory of growth of populations will be presented briefly, and then the data available for avian species. I am indebted to Dr. R. V. Rider for advice on the mathematical aspects of this paper.

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At the beginning we should have a clear idea of the subject being discussed. A population of birds may grow just the same as a population of cells (an individual bird) grows. This population will increase until it reaches the maximum number that the area can support. Although in the laboratory, conditions can be kept constant so that an area will support a certain number, in nature the conditions change every year so that the area can support a different number every year. These changes in conditions cause frequent changes in the size of the population. It is essential to distinguish between two entirely different problems: (1) the growth of a population under stationary conditions; and (2) the changes in a population due to changing conditions. The first problem is the concern of this paper; the second problem will be discussed only in reference to the first.

As might be expected, the theory of populations was developed by studies of human beings and then checked by laboratory experiments. The literature on the subject is tremendous, but Pearl (1940) gave a recent summary of theory and a list of references. It was found that the growth of the human population of the United States could be described by a curve called the logistic (Fig. 1). This curve is characterized by slow initial growth, then rapid growth, and then stability at the upper asymptote. Laboratory work on fruit flies, bacteria, and protozoa confirm this relationship. In nature, however, birds do not show these relations very satisfactorily. Data for the lower part of the curve are hard to get because a species is seldom far enough below the upper asymptote to be suitable for study, and it is impracticable to reduce a species to such a low level. Data for the asymptotic part of the curve are scarce because in nature the asymptote varies from year to year and confuses the analysis by superimposing the changes

caused by the environment upon changes due to growth. Hence for practical purposes the central and upper section of the curve is the only part that can readily be observed in nature. When a population is in the central part of the curve, it is so far below the capacity of the

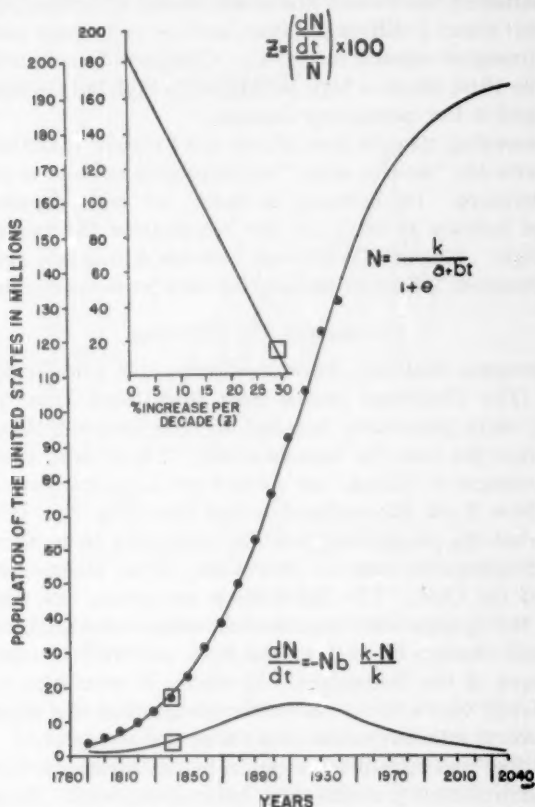


FIGURE 1. The growth of the human population of United States, the rate of growth (first derivative) and the percentage increase.

area (the asymptote) that its growth is independent of usual annual variations in food and shelter. It should be noted that the central section can be drawn as a straight line without altering the curve significantly.

Thus far we have considered the increase in numbers (N). Now let us consider the rate of increase per unit time (dN/dt) as shown in the lower curve (Fig. 1). The rate is low at first, increases to a maximum, and then decreases to zero at the upper asymptote.

Now lastly let us consider the percentage increase (Z) given in Figure 1. These values are obtained by dividing the rate of increase (dN/dt) by the population (N) at that date. The result is a descending straight line (Fig. 1). Consider a specific example. In the year 1840 the population of the United States was about 17 million; the rate of increase was about 5 million per year, and the percentage increase was about 29 (compare squares in Fig. 1). Consideration of another year, for example 1940, shows a high population, a high but declining rate of increase, and a low percentage increase.

The descending straight line (Z) requires special attention because it agrees with the "inverse ratios" so frequently referred to in ornithological literature. Its meaning is clear. At high populations the percentage increase is low. At low populations the percentage increase is high. Thus, the percentage increase is inversely proportional to the population. Now let us consider data for some species of birds.

INCREASING POPULATIONS

The European Starling, *Sturnus vulgaris*, is a suitable species for analysis. The Christmas census data from 'Bird Lore' (Audubon Magazine) were generously supplied by Dr. Leonard Wing for the Starlings seen per hour for various states. These data, smoothed by moving averages of threes, are plotted on semilogarithm paper by years for New York, Massachusetts, and Ohio (Fig. 2). It is at once apparent that the populations increase logistically to an asymptote of about 40 Starlings per hour for New York, 35 for Massachusetts, and perhaps 20 for Ohio. The fluctuations are great, but the flocking habits of the species and variations in census methods, as well as usual annual changes in weather and food, probably are adequate to explain much of the fluctuation. However, it should be mentioned parenthetically that a more elaborate treatment of the theory of the logistic predicts inherent oscillations about the asymptote.

The Starling was introduced essentially into a vacuum in the sense that the environment permitted the birds to increase. Basically the same situation would be obtained if a species, for example Robins, were reduced by poisoning to a small fraction of their present population. Note especially in this hypothetical (and impossible) reduction that the environment was not altered. In other words the upper asymptote was not changed for the Robins. The asymptote for the Starlings was far above their population level until about 1930 in New York.

Data for other introduced species are not available or suitable except for Einarsen's (1942, 1945) reports on the increase of Pheasants

on an island. In 1937, two males and six females were introduced. A spring census in succeeding years gave 40, 100, 426, 844, 1540, and 1898 birds or a percentage increase of 400, 230, 438, 118, and 43 per cent, respectively. Although the data are meager, there is a suggestion of a decline in the rate of increase with increasing populations.

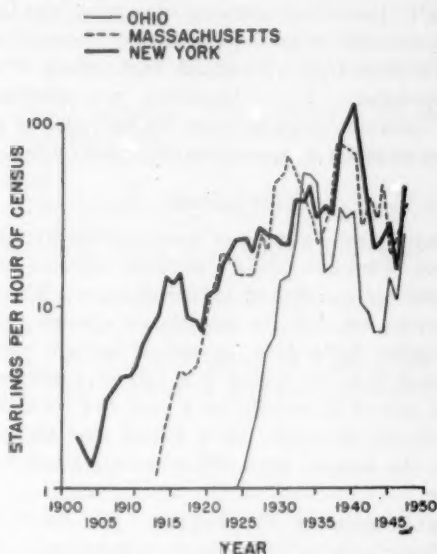


FIGURE 2. The number of Starlings seen per hour in three states, calculated by moving averages of threes.

Perhaps the best documented observations are by Errington (1945) on Quail. He was dealing with a natural population in an environment which was changing, that is, the upper asymptote was moving up and down. If we assume that each phase discussed by Errington has a different level for the asymptote, then the expected relation of population and the rate of increase is fairly clear. For example, from his Figure 6 we can set up a table for population density and per cent gain: 45 (262%); 97 (228%); 122 (188%); 196 (112%); 236 (69%); 288 (43%); 290 (40%); and 339 (28%). Errington also summarized from other authors' data which, although usually meager, agreed with this inverse relationship.

Lack (1946) presented data for 19 years on the Heron population in England. Generally the increases vary inversely with the population.

Fisher and Venables (1938) plotted data for the increase in Gannets at a gannetry. These data agree with the theory of the logistic.

Kendeigh (1934: 309) presented data about House Wrens from which he concluded that "the number of broods per female per season tends to vary inversely with the total population" although his data are not statistically convincing. However, Kendeigh (1937: 103) remarked later that "percentage increase in number was found not to be correlated with number of adults present." It must be emphasized that Kendeigh's data refer to annual fluctuations of a supposedly asymptotic population. It is, therefore, not surprising that the "inverse ratio" does not occur because the fluctuations do not depend upon population as much as upon environmental factors.

DISCUSSION

This paper makes no pretense of covering the literature for every possible evidence of inverse ratios. Actually suitable data are practically non-existent for a sufficient period of time. The data from the Christmas censuses are fine for introduced species, and some game management studies have data for almost enough years. But it is necessary to have data on spring and fall populations or on spring population and success in nesting for a period of 20 to 30 years before suitable analysis can be done. It is hoped that the presentation of the theory and the meager data will stimulate studies of this fundamental problem.

Another aspect requires clarification. We have referred to a fluctuating environment and asymptotic population. To know something about the capacity of the environment to support birds it is necessary actually to measure the environment. We should have data, not on Starlings per hour or Quail per acre, but on Starlings per pound of food or Quail per nesting site. The bewildering complexity of this task should not daunt us but should stimulate a concerted effort towards a solution even though several generations of ornithologists will be required for completion.

SUMMARY

The rate of increase of a population may be described by the logistic curve which predicts a slow initial increase, then a rapid growth, followed by a stationary population at the upper asymptote. The number of Starlings per hour recorded by the Christmas bird census for New York, Massachusetts, and Ohio fits the logistic curve reasonably well. It is of primary importance to distinguish between changes of asymptotic populations which depend upon the environmental

capacity and, on the other hand, changes of growing populations, which depend upon the population level.

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A NESTING STUDY OF THE BRONZED GRACKLE

BY ARNOLD PETERSEN AND HOWARD YOUNG

DESPITE its abundance and accessibility for study, the Bronzed Grackle, *Quiscalus quiscula versicolor*, is poorly represented in the literature. The following material on the reproductive activities of this species was obtained during the spring periods of 1947 and 1948 at Ho-Nee-Um Pond, a small portion of the University of Wisconsin Arboretum, at the outskirts of Madison, Wisconsin, and in 1949 at Vilas Park, Madison. Searches made about twice a week insured finding a high percentage of the nests, and the histories of most of these were closely followed. The period included in the study each year extended from the third week of March through the second week of June. About 75 man-hours were spent in the field each year.

The Ho-Nee-Um Pond Area is a low-lying, five-acre park on the northwest shore of Lake Wingra with several irregular plantings of closely spaced arbor vitae, *Thuja occidentalis*, in which the grackles nested. Vilas Park is at the northern end of Lake Wingra, about one mile from Ho-Nee-Um. The nesting cover used here consisted mainly of honeysuckle shrubs, *Lonicera tartarica*.

PRE-NESTING OBSERVATIONS

The first grackles arrived in the third week of March in all years, the males preceding the females by about a week. During the pre-nesting period there was considerable movement by the birds. They were usually seen in small groups of both sexes, spending much time perched in tall trees and flying about in and near the nesting areas. In early April, grackles color-banded at Ho-Nee-Um were seen one mile northwest, one mile southwest, one mile northeast, and on the opposite shore of Lake Wingra, about a mile and a half east. The wide ranging habits of the grackle have been previously described by Laskey (1940: 29) who raised a nestling. It was once captured two and one-half miles north of its foster home, and a few days later was caught a mile or more southeast of its home, to which it subsequently returned.

Courtship started with the arrival of the females about the last week in March. The courtship took place in the trees, the males lifting and spreading their tail feathers, and emitting three or four 'clucks,' followed by a rasping 'skreeek.' Most courtship performances observed were group projects, that is four or five males displaying to one female. In 1947 a female carrying nest material was still escorted by several males.

On April 5, 1949, a pair of grackles was observed courting in an elm tree one block from the Ho-Nee-Um Pond Area. The male repeatedly picked up and moved a bit of paper with his bill, replacing it in a crude nest consisting of a few twigs in a crotch about 25 feet above the ground. He frequently lifted his wings, spread his tail, and 'skreeked.' The female, perched about a yard away, also held a scrap of paper in her bill, but she remained more quiet than the male. Twice the female flew at the male, but he remained at the nest. The performance lasted about five minutes until both birds flew, the male to a nearby spruce tree and the female farther and out of sight. Two weeks later, when other nests were nearing completion, this nest was noted to have increased in bulk, but to be loosely built. It never was completed or contained eggs.

During the early part of nest building each year, numerous nests were found which were deserted in a beginning stage of construction. The courtship activity observed in 1949 suggests that these may have been nests built by courting males.

Forbush (1927: 458) described the males as fighting fiercely for the females and stated that when a nesting colony has been established there are frequent battles. No such behavior was observed during this study. The group maintained flocking habits during the entire breeding cycle, and though occasional fights were seen, the chases were very desultory, and as a rule the birds were extremely peaceable.

The question arises as to whether the indications of polyandry are due to an excess of males in the population. Snyder (1937: 39) recorded the sex ratio of 204 Bronzed Grackles trapped in Ontario during late March and found 48.5 per cent males and 51.5 per cent females. However, Trautman (1940: 391) noted a predominance of males among early transient grackles. Of 94 birds trapped in Madison during the spring seasons of 1947-48-49, and sexed by plumage characters, 55 (58.5 per cent) were males. No significance is attached to this small sample because of possibilities of differential trapability and of error in sexing.

Further samples of sex ratios are needed, as well as field observations on marked birds, before a clear understanding of the mating habits of this species can be gained. Unfortunately the grackles were very adept at removing color bands, which greatly hampered certain aspects of the study.

Considerable variation was noticed in the trapped birds, especially in the males, as to size, stoutness of the bill, and thickness and roughness of the tarsus. A careful study might show these to be acceptable age criteria. Two females had deep brown irises instead of the usual

pale yellow, and one female had an eye in which the iris was partly brown and partly yellow.

NESTING ACTIVITIES

The earliest nests were started in the first week of April. Most nests had been started by the last week of April (Fig. 1). Among nests which eventually received eggs, four general stages of nest building were recognized: 1) platform (flat, no cup); 2) half complete (sides built up, no lining); 3) nearly complete (mud lining); and 4) complete (soft grass lining, no eggs). There was considerable variation in the length of time used in nest building. Several nests were started at least 16 days before the first egg was laid, and one nest was known to have been built in four days. The average length of each stage of nest building in the two seasons at Ho-Nee-Um Pond is shown in Table 1. Nests found in advanced stages of construction were dated on the basis of these averages each year. For example, a nest which was half complete when first found on April 10, 1948, was considered to have been started five days earlier, on April 5. The dates used in Figure 1 (except before April 29 in 1949) were determined mainly by direct observation, but partly by this method of estimation.

TABLE 1
LENGTH OF NEST BUILDING IN DAYS (BRONZED GRACKLE)

Stage	1947		1948	
	Average	Extremes	Average	Extremes
Platform to half complete	2	1 and 4	5	1 and 8
Half complete to nearly complete	3	0 and 7	3	1 and 9
Nearly complete to complete	2	0 and 4	3	1 and 6
Complete to first egg	4	0 and 14	3	0 and 11
TOTAL	11	4 and 16	14	4 and 16

At Ho-Nee-Um, all of the nests were located in arbor vitae. Little preference for edge was shown, the grackles building indiscriminately in the border trees or in the middle of the plantings. Nest trees varied in height from 9 to 23 feet with an average of 12 feet. Aside from the obvious limitations there appeared to be no correlation between tree height and nest height.

Most of the nests were suspended between two or more upright trunks several inches apart; the rest were fixed in lateral branches or in deep crotches. Vines, coarse grasses, and bits of paper were used for the platform, suspending loops, and sides of the nests. A partial lining of mud was added, and finally the dried mud-cup was lined with soft grasses.

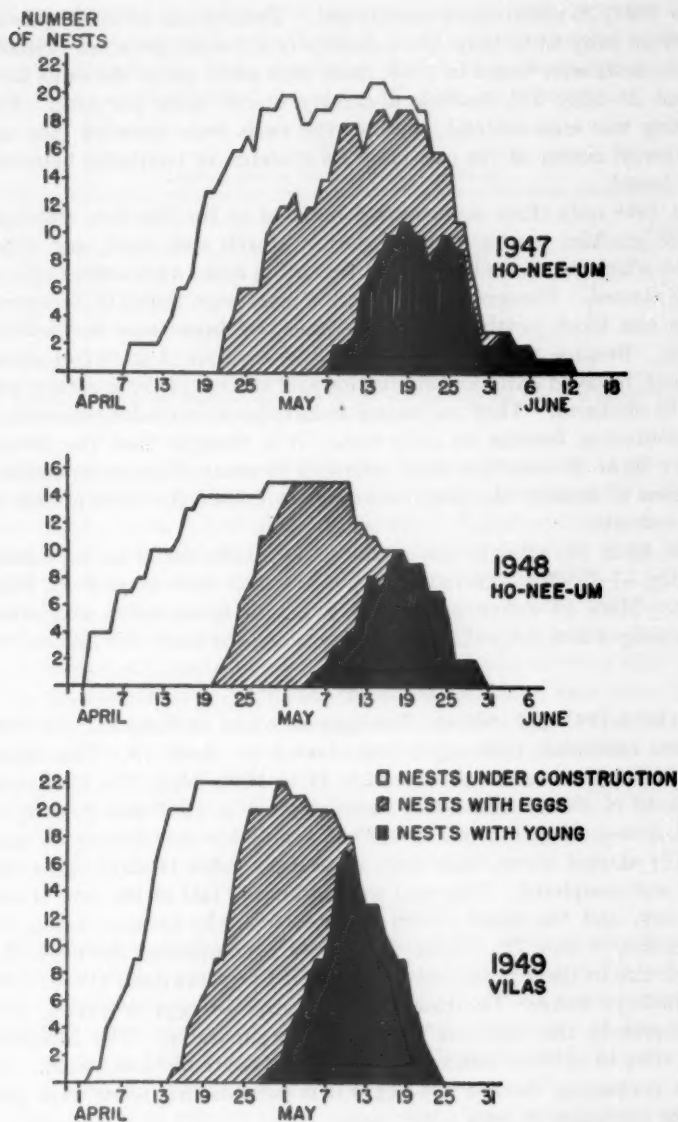


FIGURE 1.—Nesting Cycles of Bronzed Grackles. The 1949 graph previous to April 29 was made entirely by interpolation from 1947 and 1948 averages.

In 1947, 26 active nests were found. Twenty-one of these were in use from May 13 to May 15—a density of 4.2 nests per acre. Fifteen active nests were found in 1948; these were all in use at the same time (April 28–May 11), making a density of 3.0 nests per acre. The nesting was semi-colonial; most of the nests were crowded into the southwest corner of the area, and no evidence of territorial behavior was found.

In 1949 only three nests were completed at Ho-Nee-Um, although many grackles were seen there during March and April, and other nests, which may have been built by courting males as described above, were started. However, seven grackle nests were found in deciduous trees one block northwest, where there had been none in previous years. Because they were in inaccessible locations 25 to 35 feet above ground, detailed data on construction and success of these nests could not be obtained. They are known to have been active by observation of incubating females on each nest. It is thought that the disturbance from construction work adjacent to areas of previous concentrations of nests at Ho-Nee-Um may have caused the birds to nest in the new site.

On April 29, after it was realized that there would be no colony nesting at Ho-Nee-Um in 1949, observations were started at Vilas Park. Here 21 active nests were found in honeysuckle and other shrubbery which formed a dense hedge along the brow of a hill.

EGGS AND YOUNG

In both 1947 and 1948 the first eggs were laid on April 21. In 1949 it was estimated that egg-laying started on April 15. The latest starting date for a clutch was May 11 in 1947, May 2 in 1948, and April 30 in 1949. The latest hatching date in 1947 was June 1, in 1948 it was May 17, and in 1949 it was May 11. Laying of eggs usually started about three days (extremes, 0 and 11 days) after the nest was completed. The eggs were ordinarily laid at the rate of one per day, and the usual clutch-size was five, the average being 4.9 (extremes, 3 and 7). Table 2 presents a comparison between the clutch-size in these nests and those studied by Trautman (1940: 390) at Buckeye Lake. Trautman's figures refer to eggs or young, and consequently the data are not strictly comparable. The Madison data refer to nests in which the clutch was apparently completed. In those containing three or four eggs it is possible that some were lost due to predation or some other cause.

The first full clutch was completed on April 27 in 1947, April 25 in 1948, and April 18 in 1949. Incubation (measured from time of com-

pletion of clutch to hatching of first egg) usually took 11 to 12 days. One clutch of four eggs, none of which developed, was incubated for 22 days in 1948 before being deserted. Males were never flushed from nests, and apparently the females did all of the incubation.

TABLE 2
CLUTCH-SIZE IN THE BRONZED GRACKLE

		Number of Eggs					Average
		3	4	5	6	7	
Number of nests	Madison 1947	0	2	13	4	0	5.1
	Madison 1948	1	2	10	2	0	4.9
	Madison 1949	2	5	13	0	1	4.7
	Buckeye Lake	0	8	8	4	1	4.9*
TOTAL		3	17	44	10	2	4.9

* Trautman's figures for Buckeye Lake refer to eggs or young and are, therefore, not strictly comparable to the Madison data on completed clutches of eggs.

The young usually remained in the nest for about 12 days. This varied from 10 to 17 days, each extreme being represented by a single nest. Quite often one or two young would fledge several days after the other nestlings had left. The earliest fledging occurred May 22 in both years at Ho-Nee-Um, and May 12 in 1949; most fledging took place in the last week of May, but in 1947 it extended through June 12. Bierman (1944: 75) found young grackles still in the nest on June 26, 1944, in Forest County, Wisconsin, about 200 miles north of Madison.

At the time of leaving the nest the young generally were poor fliers, but they soon took up the wandering habit. Very few banded fledglings were seen on the areas after they were more than two or three days out of the nest. At the same time there was a noticeable influx of unbanded grackle fledglings. Trautman (1940: 391) noted that young grackles at Buckeye Lake left the nesting area almost as soon as they had fledged.

SUCCESS IN NESTING

The average number of young produced by nests which survived the entire nesting period was 4.3 in 1947, 3.9 in 1948, and 3.8 in 1949, with a three-year average of 4.0 (Table 3). While each successful nest was more productive in 1947, a lower percentage of the nests (45 per cent) produced young that year than in 1948 (53) or 1949 (67) (Table 4).

The number of successful nests in all three years was 55 per cent of the total number of active nests. Nice (1937: 143) summarized the data in five studies of various species (mostly open nests of passerines)

and found a 45.9 per cent nest success. Young (1949: 45) also reviewing literature computed 74 per cent for 941 nests of four passerine species. The nest success determined in this study (55 per cent) is intermediate to the averages reported by Nice and Young, and more closely approaches the average nest success of 49.8 per cent found by Young (1949: 44) in his study of 110 nests of five passerine species nesting at Ho-Nee-Um in 1947.

TABLE 3
FLEDGING OF BRONZED GRACKLES

	Number of Young Fledged per Nest						Average
	1	2	3	4	5	6	
Number of nests							
{ 1947	1	0	1	3	7	0	4.3
{ 1948	0	1	1	4	2	0	3.9
{ 1949	0	2	3	5	4	0	3.8
TOTAL	1	3	5	12	13	0	4.0

Predation, desertion, and inclement weather were the causes of all nest failures in grackles, as shown in Table 5. Adverse weather conditions early in the season probably caused some of the failures attributed to desertion and so may be a more important factor than the summary indicates. The effect of storm damage was possibly intensified at Ho-Nee-Um by the spindly nature of the trees used for nesting.

TABLE 4
NESTING SUCCESS OF THE BRONZED GRACKLE

	1947	1948	1949	Totals and averages
Active nests	26	15	21	62
Per cent successful	45	53	67	55
Number of eggs	117	73	98	288
Number hatching	84	53	72	209
Per cent hatching	72	73	73	73
Number of fledglings	51	31	53	135
Per cent of young fledging	61	58	74	65
Per cent of eggs producing fledglings	44	42	54	47

Much of the predation is known to have been by young boys. The fact that both study areas were situated near public recreation areas made these nests particularly vulnerable to such interference. Other possible predators included: the Norway Rat, *Rattus norvegicus*; Blue Jay, *Cyanocitta cristata*; Crow, *Corvus brachyrhynchos*; Opossum, *Didelphis virginiana*; Garter Snake, *Thamnophis* sp.; and Chipmunk, *Tamias striatus*. On one occasion a grackle and a robin were seen in

common pursuit of a Blue Jay. There were several Cowbirds, *Molothrus ater*, at Ho-Nee-Um, but no Cowbird eggs were ever found in grackle nests. Friedmann (1925: 215) listed several instances in which Cowbirds laid eggs in Bronzed Grackle nests. Yellow Warblers, *Dendroica petechia*, nesting on the Ho-Nee-Um area were heavily parasitized by Cowbirds, and a grackle was once seen chasing a Cowbird.

TABLE 5
CAUSES OF FAILURES IN NESTS OF BRONZED GRACKLES

NEST FAILURES	1947	1948	1949	Total	Per cent
Predation	4	3	5	12	43
Desertion	8	2	2	12	43
Weather	2	2	0	4	14
TOTAL	14	7	7	28	100
EGGS NOT HATCHING	1947	1948	1949	Total	Per cent
Predation	19	8	10	37	47
Desertion	2	1	3	6	7
Infertile or addled	3	6	9	18	23
Unaccounted for	9	5	4	18	23
TOTAL	33	20	26	79	100
YOUNG NOT FLEDGING	1947	1948	1949	Total	Per cent
Predation	0	12	11	23	31
Desertion	9	4	4	17	23
Weather	17	3	0	20	27
Fell from nest	1	3	2	6	8
Died in nest	1	0	1	2	3
Unaccounted for	5	0	1	6	8
TOTAL	33	22	19	74	100

The young bird which died in the nest in 1947 had been banded, and the banded leg was broken and macerated, apparently by the bill of the parent. Beer (Unpublished Field Notes, 1947, Univ. Wis.) reported a similar incident in the Red-winged Blackbird, *Agelaius phoeniceus*. Possibly the whitish color of the band released the nest cleaning behavior of the parent, causing it to peck repeatedly at the banded leg. Lovell (1945: 145) recorded an incident in which a Song Sparrow, *Melospiza melodia*, dragged a banded young from its nest and pecked at the band until the leg was broken.

Since the nests were very closely followed, it was possible to determine or to approximate closely the time at which eggs and young disappeared as a result of predation or other causes. These data have been used to construct the survival curves for the period in the nest; they are plotted in Figure 2. Eggs known to be non-viable were

excluded in this computation, while Tables 2 and 4 include all eggs laid.

The survival curves are quite different for the three years, as can be seen at a glance. However, the Ho-Nee-Um curves are similar in that the loss of young exceeded that of eggs, and survival to time of fledging was nearly the same in both years. The Vilas Park data closely parallel the three-year average during the incubation period, but show a greater than average survival of young. The 1949 (Vilas) season appears to be the most successful, since 63 per cent of the reproductive potential of viable eggs was attained.

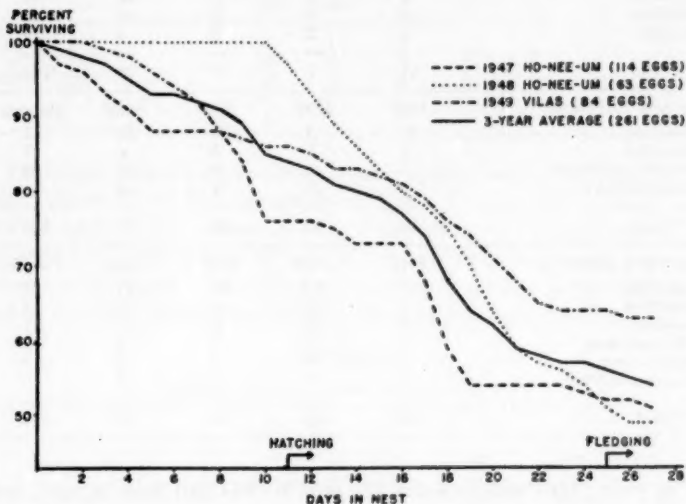


FIGURE 2.—Survival of Eggs and Young of Bronzed Grackles.

The three-year average in Figure 2 shows a rather uniform rate of mortality from egg-laying to fledging, with about 54 per cent of the viable eggs producing young. The potential yearly increase of grackles from these colonies was, therefore, nearly halved before the young had left the nest. Since a heavy mortality is usually to be expected among young birds immediately after fledging, a rather high survival rate of adults is needed to maintain the population.

SUMMARY

1. The nesting behavior of Bronzed Grackles was studied during three breeding seasons at Madison, Wisconsin.

2. Males arrived on the nesting area the third week in March, about one week before the females; courtship started with the arrival of the females. Most courtship performances observed were in groups of four or five males displaying to one female.

3. The grackles range a mile or more from their nest sites, at least during the early part of the season.

4. Nest construction started the first week in April. In one colony the nests were built in arbor vitae; in the other they were built in dense honeysuckle hedges.

5. Nests were constructed by the females. However, a male courting a female was observed arranging nesting material in a loosely constructed nest which never contained eggs. Each year a number of nests were deserted in an early stage of construction.

6. The earliest eggs were laid on April 21 in 1947 and 1948, and April 15 in 1949. The latest starting date for a clutch was May 11. From three to seven eggs were laid, most nests had five eggs, and the average clutch was 4.9 eggs.

7. The earliest full clutch was completed on April 27 in 1947, on April 25 in 1948, and on April 18 in 1949. Incubation (clutch completion to first hatching) took 11 to 12 days. The female did all the incubating.

8. The young usually fledged at about 12 days of age (extremes, 10 and 17 days). The earliest fledging date was May 12; the latest was June 12. The young usually left the areas two or three days after fledging.

9. Fifty-five per cent of all nests were successful (produced at least one fledgling). These nests produced an average of 4.0 fledglings. Predation, desertion, and adverse weather were the causes of all nest failures. Of the 288 eggs laid, 73 per cent hatched and 47 per cent produced fledglings. Predation, mainly by young boys, was the greatest factor in loss of eggs and young.

10. The survival curve to fledging time for all individuals (from viable eggs) shows a uniform rate of mortality. Loss of nestlings exceeds loss of eggs. The potential yearly increase of grackles from these colonies was reduced by nearly one-half before the young had left the nest (54 per cent of the viable eggs produced fledglings).

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*Department of Zoology, University of Wisconsin, Madison,
December 28, 1949.*

THE BLACK GUILLEMOTS OF KENT ISLAND, BAY OF FUNDY

BY HOWARD ELLIOTT WINN

THE following study of the Black Guillemot, *Cepphus grylle* (Linnaeus), was conducted at Kent Island and neighboring Sheep Island during the summers of 1946 and 1947, upon the suggestion of Dr. Alfred O. Gross.

Kent Island, one of the group called Three Islands, is in the Grand Manan Archipelago in the Bay of Fundy, New Brunswick, Canada. Its rocky shore is excellently suited for the nesting of the Black Guillemot. The smallness of the rocks facilitates observation of the eggs and young, whereas on nearby Southern Green Island most of the nests are inaccessible because they are under huge boulders. The major portion of my work was carried out on Kent Island, but Sheep Island, uninhabited and less frequented than Kent, was used for more accurate study of mortality.

During the summer of 1947, about 50 pairs of Black Guillemots nested on Kent Island. In the first part of July, I noted the presence of about 50 extra, non-breeding guillemots in summer plumage. After about a week of disporting and feeding off Kent Island they moved onward, and another or the same non-breeding group came to the shores of Kent in the latter half of July. The birds in these groups were probably one-year-old birds that had not attained sexual maturity although they might have been older birds that had not succeeded in raising a brood. Many young guillemots have been banded at Kent Island but no returns have been reported during subsequent nesting seasons.

The guillemots became quite accustomed to the burlap blinds that I used, and my handling of the young and adults did not seem to affect their normal behavior. A single-beam trip scale was used for weighing chicks and eggs; a vernier caliper, a 30-centimeter plastic rule, and a pair of dividers were used for the various measurements.

SPRING ARRIVAL

Guillemots in breeding plumage arrive at Kent Island about the first of March and stay offshore in open water until the middle of April, when they come up on the rocks. According to Ernest Joy, warden of the island, the first guillemots appeared offshore March 3, 1937, March 12, 1938, March 9, 1940, and February 26, 1941. He noted that the first individuals came to the rocks on April 8, 1947, and on April 10, 1938.

COURTSHIP

Courtship starts about the middle of May and ends in late June. The courtship follows an intricate pattern in the water and on the rocks. Generally, the birds are in groups ranging in numbers up to 25 with a mean of about 10, even after pairing takes place. In the early stages of courtship, it is thought that the attention of a male may be directed toward several females, but later the male seems to focus his attentions on one female.

On June 10, 1947, two adults climbed to the peak of a rock that was soon to be covered by the tide. They faced each other, bowing and whistling as they slowly turned in a circle. It appeared that the male was trying to get behind the female, but the female turned in a circle, preventing him from doing so. Suddenly the female, whistling intermittently, squatted flat on the rock with her neck outstretched and tail directed upward. The male stepped on the female, placing his feet squarely on her back and pushing downward alternately with right and left feet while copulation took place. There was none of the fighting or struggling that is characteristic of many other birds. After copulation, the pair went back into the water. As they were swimming around, another adult came close to them, but the mating pair apparently paid no attention to the third adult. They faced each other, whistling, and swimming in circles. Suddenly the female dove under water, and the male quickly followed. They bobbed up some 10 feet away, where they again circled each other. Then the male swam after the female with a peculiar side to side motion caused by the rapid alternate paddling of the feet. The female then took to the air for 20 feet, the male quickly following. Slowly the female led the chase on to a projecting rock where they again followed the courtship pattern until it ended in copulation. This time they remained on the rock, sitting beside each other, whistling, looking at each other, and apparently resting. This, in general, was the usual daily courtship pattern of the Black Guillemot on Kent Island.

The copulating position is maintained from 10 seconds to a minute, during which time the male's tail is pressed down only part of the time. Copulation occurs at any time of the day, although it seems to be most frequent during mid-morning and mid-afternoon. The times of copulation that were recorded are as follows: 9:30 a. m., 10:30, 10:30, 10:30, 11:00, 12:00 noon, 1:30, 2:00, 2:00, and 2:30 p. m. An attempt to correlate the time of copulation with the condition of the tide was unsatisfactory because of the limited number of observations at low tide. Hyde (1937: 30) stated that copulation occurs both in and out of water, but in no instance, during a full month's observation of

courtship, did I see anything that could be called copulation in the water.

In three instances, a female that had a two-day-old chick was observed to assume the copulating position, but in these instances the female quickly upset the male as he attempted to mount. This type of behavior is rare. The pattern of courtship behavior in the water is carried on throughout the summer, but it does not end in copulation. Often a bird (either immature or unsuccessful in raising a brood) will carry on courtship activity with a female that has eggs or chicks. However, if this non-breeder approaches closer than about three feet to the nest, it is immediately chased away.

NESTS AND EGGS

On June 10, 1947, a pair of guillemots, after copulation, went to the rocky shore, where they searched in many nooks and corners of the rocks, apparently looking for a suitable place to build a nest. Immediately, I built a nesting cavity of large rocks in the region they were investigating. On June 19, I found one egg in the newly constructed crevice where a small cup had been shaped out of the pebbles that I had placed there. The eggs of two nests were destroyed June 8 and June 14, and eggs were relaid in them on June 24 and 29, respectively. Thus it took these birds approximately 15 days or less to replace their clutches. Eggs destroyed after the last of June were seldom, if ever, replaced.

The nests are usually placed between the high tide mark and the line of growing vegetation. However, on Sheep Island several nests were placed under rocks amongst yarrow (*Achillea borealis*), silver weed (*Potentilla anserina*), and sea parsley (*Ligusticum scoticum*). The adults bit off these plants when they grew across the entrance of the nest.

On Kent Island the eggs are regularly laid on a cup of small pebbles in a darkened crevice, although a few have been found on bare rock. Four nests were lined with seaweed, and it is interesting to note that none of the eggs in these nests hatched. I found feathers and bones of the Herring Gull, *Larus argentatus*, fish bones, sea urchin skeletons, gastropod shells, plant stalks, and small sticks in the nests on Kent and neighboring islands. Many places amongst the rocks afforded good nesting places but were never used if even a small amount of water was present in the crevice.

The eggs are laid, either during the night or more probably in the early morning, between the first of June and the early part of July. In 1947, 39 nests contained two eggs, nine had one egg, and one had three eggs. In 16 nests during the same summer, the eggs were laid

three days apart in 13 nests, two days apart in two, and four days apart in one.

The mean width and length of 77 eggs measured in 1947 were 57.7 by 38.9 millimeters. The extremes (in italics) were as follows: 63.7 by 38.3; *51.6* by *35.0*; 60.3 by 42.3.

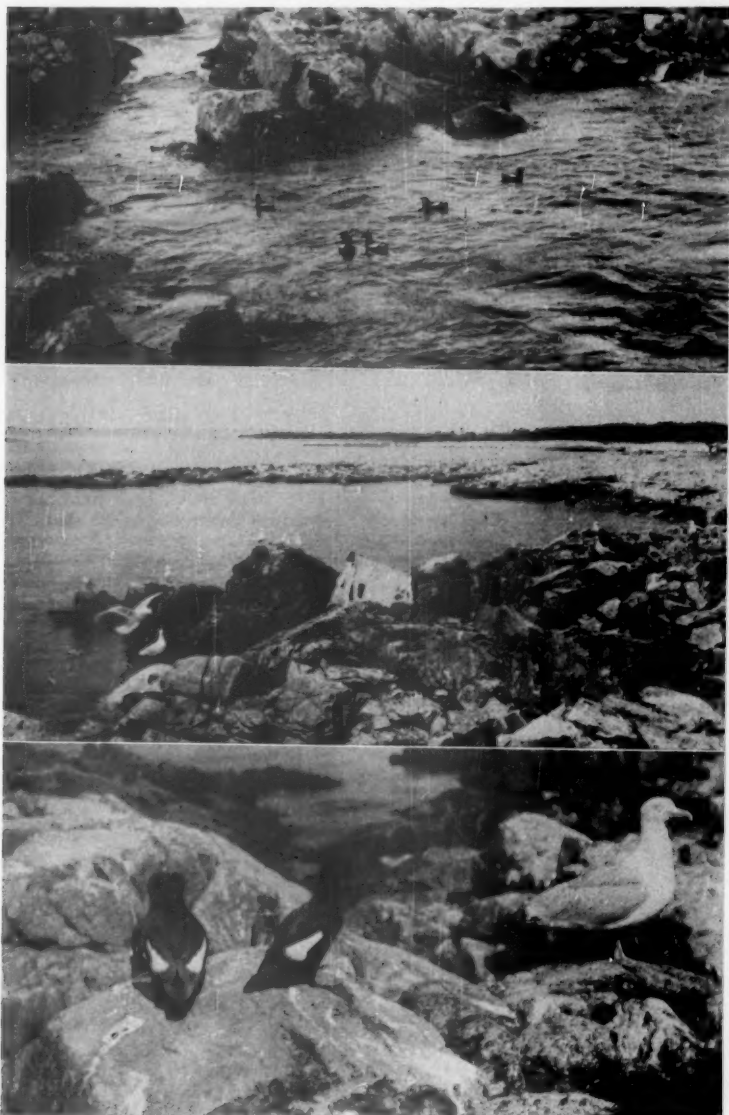
The weights of four eggs at the time of laying and on the day before hatching were: 50.35 and 41.71 grams; 50.54 and 44.41; 54.18 and 44.33; 46.13 and 38.54, representing an average 16 per cent loss in weight. The results of weighing four eggs throughout the incubation period are as follows: the eggs lost an average of 0.3 grams per day until pipped; the average weight loss was 1.5 grams per day after pipping.

It is very difficult to determine when incubation actually begins, but it seems to be between one and five days after the last egg is laid. Usually it is within one day after the laying of the second egg. Bent (1919: 159) reported the incubation period to be about 21 days, which is the time that has been generally cited throughout the literature. Incubation periods given by Witherby, *et al* (1945: 163) vary from 24 days to about four weeks. Hyde (1936: 15, and 1937: 31) reported that two eggs hatched after 28 days of incubation, two after 27 days, one after 26 or more days, and one after 23 or more days. In 1947, I checked all the nests daily until the eggs were laid. Seven eggs hatched after being incubated 28 days. These were in four nests where I had definitely established the beginning of incubation. The periods between laying and hatching of five other eggs were 29, 30, 32, 33, and 33 days. These facts would definitely place the incubation period at about 28 with a possible range of 27 to 33 days.

In several nests attended by banded birds, one adult usually was found incubating the eggs in the morning at about 10 o'clock. The other member of the pair was on the nest in the afternoon at about 2 o'clock. Hantzsch (1905: 111) stated that the males were always found on the nest at night while the females were on the nest during the day. On visits to a nest at about 10 and 3 o'clock daily I found the eggs cold at these times, on consecutive visits on from one to four days. Nevertheless, the eggs hatched.

Several eggs that were not going to hatch, which I judged by the lack of normal weight loss and by their being cold and damp for a long period, were apparently pushed out of the nests by the adults. In four such instances, I put the eggs back, only to find them pushed out again on the following days.

By moving rocks around one nest so that there was an opening just above the eggs, it was possible from the blind to watch the adult incubate. The following was observed on June 26, 1947—an adult



(Top) BLACK GUILLEMOTS IN THE WATER BELOW THEIR NESTS, BAY OF FUNDY.
(Middle) TYPICAL NESTING AREA OF BLACK GUILLEMOTS ON KENT ISLAND.
BLIND IN CENTER. (Bottom) BLACK GUILLEMOTS PERCHED ON ROCK NEAR
THEIR NESTS.



entered the nest after a cautious approach to the entrance seemingly caused by the presence of Herring Gulls. She "crawled" a few inches at a time into the crevice until finally she reached the eggs. At first she partially covered the eggs while inspecting the new opening above the nest. After a minute or two she settled down on the eggs, but immediately stood on one leg while turning the eggs over with a scratching motion of the other leg. She uttered a whistling note once in the nest; the remainder of the time she kept turning her head about, looking at the new hole. Very often one parent sits outside the nest while the other incubates.

HATCHING

The eggs of a single set usually hatch on the same day, although the eggs in one nest hatched as much as three days apart. The times between hatching of the two eggs in each of four sets, accurate within two hours, are as follows: 2, 3, 6, and 10 hours. The eggs of four other sets hatched less than 24 hours apart. It requires from three to four days for each egg to hatch. Hyde (1937: 31) described the hatching as follows: "First day: egg is cracked but not punctured. Second day: egg is pipped, opening is about 5 mm. in diameter. Third day: size of the opening is increased to 7 x 20 mm. Fourth day: at 1:00 a. m. the chick . . . emerged from its egg." In the main, my observations substantiate this description. The hatching activity is more pronounced during the last few hours. The egg tooth is used for most of the pipping until finally a wing and the bill protrude. The tarsus then emerges, and it is used as a lever to split the egg shell at the blunt end.

The egg shell is not removed from the rock crevice, although frequently the adult removes it from the small hollow of pebbles. I have found shells from previous years, apparently still in the original rock crevice.

DEVELOPMENT OF THE CHICK

At hatching: Yolk stalk scar prominent and bare; toes curled, apparently without control of voluntary muscles; young crawl well; eyes open and bulging; down dry within two or three hours; ear-opening prominent; large, white egg-tooth present; webs of feet flesh-colored with conspicuous blood vessels; skin pink; mouth lining cardinal; iris chestnut; and toes, legs, and nails black.

One day: Completely covered with black down, ventral part a little lighter; and yolk stalk scar partially covered with down.

Five days: Eyes appear normal; yolk stalk scar inconspicuous; and papillae of only scapular feathers conspicuous.

Ten days: Down thin on wings; most feather papillae present; unsheathing first of scapulars, followed by that of some wing-coverts; ventral apterium conspicuous; no tail feather papillae; and webs of feet gray.

Fifteen days: Egg tooth noticeably smaller; down thin on all parts of body; feathers of ventral tract white with dusky tips; dorsal tract with unsheathed black feathers; flanks with black feathers with white tips; occipital tract with unsheathed black feathers; wing feathers black except greater secondary coverts which are white with black tip; scapulars best developed of feathers; and greater secondary coverts longer than secondaries.

Twenty days: Primaries growing rapidly; egg tooth almost gone; and very little down left.

Twenty-five days: Egg tooth and down completely lost between twenty-fifth and thirty-fifth day; and next 15 days bring about rapid growth of body and feathers.

Thirty-nine or forty days: The young, having attained full growth and the complete juvenal plumage, leave the nest after 39 or 40 days. This statement is based on one juvenile that left the nest in 39 days, two that had not left in 37 days, one that had not left in 36 days, and Hyde's (1937: 33) statement that the young leave the nest about 40 days after hatching. This is a little longer than Seton Gordon's (1928) statement that the fledging-period of a pair of guillemots was four weeks or probably five.

TABLE 1
DEVELOPMENT OF THE GUILLEMOT CHICK*

Age in days	1	2	5	10	15	20	25	30	35	39	One adult
Weight	31	38	65	180	—	282	—	354	382	384	435
Body length	125	129	146	182	215	242	264	275	274	284	330
Wing span	108	113	138	200	270	375	404	432	450	485	560
Folded wing	18	20	24	35	57	83	101	132	134	142	202
Bill gape	21	24	26	32	35	35	39	42	45	47	46
Diameter of eye	4	4.5	5	6	6	6.5	7	8	8	8	8
Tarsal length	17	18	19	24	28	34	36	34	34	33	
Length third toe	18	19	22	28	35	34	36	36	37	37	37
Length third nail	5	5	5	6	6	7	7	8	8	8.5	9.5
Rectrices					7	16	27	36	42	47	52
Rectrices, unsheathed					3	13	24	30			
Sixth primary			1	4	20	34	50	63	75	86	89
Sixth primary, unsheathed					5	18	35	51	69		
Sixth secondary			1	5	17	32	41	50	66	62	66
Sixth secondary, unsheathed				1	6	19	35	45	63		

* Figures represent average measurements in grams and millimeters of two chicks, except the figures for 39 days which are from only one chick.

Table 1 shows the development of the chick from hatching until it leaves the nest.

CARE OF YOUNG AND BEHAVIOR OF NESTLING

For the first two to four days after hatching, both adults bring live rock eels, *Pholis gunnellus*, into the nest and dangle the live fish in front of the chicks, before feeding begins. After this they start feeding the chicks two- and three-inch rock eels which they get from shoals not visible from the island. When the chick is very young it is usually fed

dead fish, but as the chick grows older many of the fish are delivered alive and squirming vigorously. Larger eels are fed as the chicks grow older and, finally, the eels average about five inches in length. The parents feed the chicks from dawn until sunset. An average of 17 fish was brought to each of four nests between 5:00 and 9:00 a. m. In a few instances, three or four dead fish were left on the floor of the nest.

The adult will often bring the fish to the entrance of the nest and utter a whistling note. The young quickly respond by "frantic" peeping and hopping about, which they continue until fed. The chick takes the rock eel head first from the parent's bill and swallows it whole. The chick then makes a few soft squeaks as it sits, until the next feeding, in the spot where the eggs were laid.

In 1946, about 90 per cent of the food delivered to the chicks consisted of rock eels; the remainder was small red sculpins, *Myoxocephalus aeneus*. In 1947, these two species entered the diet about equally. Late in the season I saw one small herring fed to a chick.

At first the chicks remain in one spot in the nest, walking about very little, but by the time they are 20 days old, they wander considerably about the rock crevice. However, they usually return and settle down in the hollow of pebbles where the eggs were laid. A chick that was 25 days old stretched its wings and generally exercised them. In some nests, this activity is often restricted because of the small size of the nesting cavity. The chicks, while alone in the nest, often peck at bits of mollusc shells. They do not leave the original nesting crevice until ready to go to the water.

When the young are 39 or 40 days old, the adults seemingly entice them out of the nests by dangling a live rock eel in front of them. This is based on one instance I observed on August 12, 1947, at about 8:30 p. m. The young are immediately led to the water and away from the island, presumably to the feeding grounds.

MORTALITY

Of 84 eggs laid in 46 nests during 1947, 44 (52.4 per cent) hatched and only 22 of the chicks attained an age of 30 days or more. This represents a 73.8 per cent loss of eggs and young. The high tides in July, which were accompanied by extremely high waves, destroyed 25 eggs and 18 chicks. Some of the remaining 15 eggs and four chicks were probably destroyed by Crows, *Corvus brachyrhynchos*, and young Herring Gulls; some of these 15 eggs probably failed to hatch due to infertility or the death of the embryo. This seems to be an extremely high rate of loss, compared with Hyde's (1937: 33) report that Crows

destroyed six nests and the tides destroyed 16 nests, of a total of 85 nests during 1935 and 1936. Although the nests are relatively safe when the eggs are deposited in June, the extreme change in tide reaches many of the nests in July. A few of the same nests in which the eggs were destroyed by the tides in 1946 were used in 1947, only to be again destroyed by the tides. In order to escape from the mid-day heat, young Herring Gulls often take refuge under the rocks where the guillemot nests are located. They sometimes crack the eggs accidentally and/or keep the adults off the nest.

On December 1, 1943, Ernest Joy found 62 guillemots that had been killed by oil along the shore of Kent Island. Mr. Joy and Mr. Allen Moses of Grand Manan told me that raccoons introduced on the southern tip of neighboring Grand Manan Island have almost completely exterminated the formerly large guillemot colony there.

RELATIONS WITH OTHER BIRDS

The Black Guillemots nest at the southern end of Kent Island, which brings them into close relation with the large colonies of Herring Gulls and American Eiders, *Somateria mollissima*. The eiders and guillemots seem to be able to live together without any competition. However, when a group of eiders is swimming along the shore the guillemots move out of the way, usually by diving. There seems to be severe competition, on the other hand, between Herring Gulls and the less aggressive guillemots. Minimum distances from the center of Herring Gull nests to the entrance of guillemot nests are as follows: 20, 21, 28, 34, and 36 inches. This is well within the minimum range of the Herring Gull's defended nesting territory. An adult Herring Gull often took rock eels from the guillemots as they flew to their nest. One Herring Gull was almost parasitic on a pair of guillemots, robbing them of their food two out of every three times they tried to approach the nest. The guillemots are usually alert and "nervous" when Herring Gulls are nearby because the gulls try to steal their food or to chase them off the rocks.

An interesting incident from my notes of July 10, 1947, illustrates a relationship between the eider, gull, and guillemot. Several guillemots were perched on the rocks, and a few were swimming in the water. One was not more than two feet from a female eider in the water, but they seemed to be in perfect harmony. Suddenly, an aggressive Herring Gull swooped down on the guillemots sitting on the rocks, scattering them into the water. The gull continued flying out over the water and tried to land on the guillemot which was swimming near the eider. The guillemot escaped by diving, while the nearby eider

with snapping bill struck out over the water after the Herring Gull. The gull left quickly and was not seen bothering any of the guillemots while the female eider remained in the vicinity.

SUMMARY

Courtship starts about the middle of May and continues to the last of June. Copulation occurs on the rocks.

Nests are usually placed between the high tide mark and the line of growing vegetation. Nesting crevices built by man are readily utilized. A destroyed clutch is replaced in about 15 days. Most nests contain two eggs, usually laid three days apart. A few nests contain one egg and, rarely, three are present. The average loss in weight of four eggs from laying to hatching was 16 per cent. The incubation period is about 28 days with a possible range of 27 to 33 days. The eggs of one set usually hatch on the same day.

There was a 73.8 per cent loss of eggs and young. The extreme high tides caused the greatest loss of eggs and nestlings.

Rock eels and small red sculpins make up the main diet of the young in the nests. The juveniles are led to the water by the parents 39 or 40 days after hatching.

The Herring Gull is a competitor of the Black Guillemot on Kent Island. There seems to be no severe competition between the guillemots and eiders.

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GROWTH BARS IN FEATHERS

BY HAROLD BACON WOOD

THE growth bars in feathers are those elusive, alternate light and dark, normal angular markings across the web of many feathers and have the appearance of watered silk without any sheen. They have been referred to as the "ribbing" by Mascha (1905), the "fundamental bars" by Whitman (1907: 13) and by Riddle (1907: 165), also "fault bars" by Riddle, as "subordinate bars" by Glegg (1945: 301), "watered barring" by Forbush (1929: 322), and called just "feather bars" by Michener and Michener (1938: 149). Since they are caused by the normal development and indicate the rate of growth of feathers, the more descriptive title of "growth bars" is recommended. Their special characteristics for a species are general uniformity, visibility, width, and angulation. Chandler (1916) did not mention these growth bars in his extensive investigation but stated (p. 281), "There are no considerable variations in the feather structure of different species of the same genus." Since these characteristics are so individualistic, definite, and descriptive, the growth bars deserve more consideration than has been accorded them by ornithologists.

These bars are most commonly seen in the wing and tail feathers, rarely in other tracts. While in most feathers they are not visible or only faintly, in some species they are very distinct in most feathers. In the feathers examined, they were as distinct in the juvenal as in the adult plumage. They are seen only by reflected light and best by tilting the feather. They are not discernible optically by transmitted light, although shadow-graphs may reveal them, nor are their outlines made more distinct by magnification or by exposure to X-rays, infra-red, ultra-violet light, phosphorescent, or polarized light. Photographs and shadow-graphs are not as clear as visual impressions.

The visibility of growth bars varies greatly among birds, from nothing to very marked. Its degree is constant for a genus. The visible bars do not occur in all species nor in all the feather tracts of any bird. Among the more than 80 species of eastern birds examined in this investigation, the growth bars were most easily seen in the: Purple Grackle, *Quiscalus q. quiscula*; Catbird, *Dumetella carolinensis*; Eastern Cardinal, *Richmondia c. cardinalis*; Eastern Robin, *Turdus m. migratorius*; and Brown Thrasher, *Toxostoma rufum*. Many other birds showed them less distinctly, but in some species the bars were so difficult to see that it became uncertain or impossible to measure their widths or angulation. They are seen in hummingbirds and in

eagles, and in many genera between. The Eastern Mourning Dove, *Zenaidura m. carolinensis*, was the only species examined which exhibited the growth bars in parctically all feather tracts and all having the same angulation. Growth bars were usually invisible in the body feathers of all the other birds.

The growth bars are found on the smooth web of any solid color, but only rarely on the soft, ciliated dorsum of owl feathers or the mirror of duck feathers. A variable pigmentation, as in mottled feathers, makes them invisible. When visible, they may be seen only on one or on both sides of a feather, only on the anterior or the posterior or on both surfaces of the remiges and/or rectrices, or on all surfaces of the involved feathers.

The growth bars develop as the growing barbs emerge from the calamus sheath; the undeveloped barbules within the sheath show no macroscopic or microscopic indication of a bar.

The broad color bands forming the patterns in feathers usually bear no relation to the growth bars, but in some species there is a developmental connection. In the House Wren, *Troglodytes a. aedon*, along the edges of the secondaries is a row of brown dots, each being the terminal ending of a dark diurnal growth bar, suggesting that each dark mark in the wren's plumage was diurnal in development. A similar arrangement is distinctly seen in the second rectrices of the Mockingbird, *Mimus p. polyglottos*, where black dots bordering the inner vane are the terminals of dark growth bars.

The difference between the light and dark growth bars is but a question of pigment, as Strong (1902) declared. This is seen readily under the microscope which shows the greater amount of lipochromic granules in the epithelial cells in the darker bars. Even white feathers show this difference in the form of pale yellowish granules. Riddle (1908) wrote, "Under poor nutritive conditions during nighttime the formation of barbule-forming cells is first checked," producing pale colored bars, an indication of the influence of diet upon the formation of the growth bars.

The rate of growth of a feather probably depends more upon the abundance of food ingested than upon the character of the food; other factors may of course be involved. While the Golden Eagle, *Aquila c. canadensis*, has very narrow growth bars, those in the Marsh Hawk, *Circus cyaneus*, vary from 4.5 to 5.9 millimeters for the pair of bars, several times broader than the eagle's bar of about one millimeter. A young Barn Owl, *Tyto alba*, from a nest containing many pellets with two to five mouse skulls in each, showed bars 1.9 mm. in width in the secondaries (no other feathers showed any bars); Great

Horned Owls, *Bubo v. virginianus*, had 2.3 mm. bars; and Screech Owls, *Otus a. naevius*, 3.1 mm. bars. Among ducks, the twin bars measured as follows: Wood Ducks, *Aix sponsa*, 3.6 mm.; Pintails, *Anas a. tsitzihoo*, 3.0; Mallards, *Anas p. platyrhynchos*, 2.0; and the American Merganser, *Mergus m. americanus*, 3.4 mm. for a pair of bars. A tame Mute Swan, *Sthenelides olor*, in a city park had 4.5 mm. growth bars in the wings. In birds of other diets we find Juncos, *Junco hyemalis*, giving a constant measurement of 3.3 mm., and Song Sparrows, *Melospiza m. melodia*, with a variable diet show measurements from 2.1 to 3.5 mm. The "gluttonous" Starling, *Sturnus vulgaris*, showed an average of 3.7, and the constantly eating Domestic Pigeon measured up to 7.6 mm. The varying rates of growth of feathers are shown definitely by the relative widths of the growth bars, and they suggest the abundance of food at the time of the development of the feathers.

Glegg (1945) observed that the rate of growth is greater in those feathers which are longest. This was shown in a museum specimen of the Forked-tail Flycatcher of Panama, *Muscivora tyrannus*, in the Pennsylvania State College collection. The central rectrices which are 8.5 inches long showed daily growth over twice that of the short lateral rectrices. The rate of growth in many birds is also much faster in flight feathers than in other tracts which are not so essential; it is faster in the remiges than in their coverts. In the Mourning Dove the secondaries showed a daily growth of 3.3 mm., their coverts only 2.1; a Robin's secondaries grew 2.6 daily, their coverts 2.1; American Merganser secondaries 3.4, tertials 2.6; Junco primaries 4.0, and rectrices 3.4 mm.

The width of a pair of growth bars is an important generic characteristic, varying with the species. The widths ranged from one millimeter in the eagle to seven millimeters in a Raven, *Corvus c. principalis*. Whitman (1907: 14) wrote, "The number of bars corresponds nearly to the number of days of growth." It definitely does in the birds in this investigation, after the emergence of the barbs from the calamus. Michener and Michener proved this point by measuring a developing feather for a number of days. To prove that the dark bars are diurnal in development and the light bars nocturnal, I plucked tail feathers. Song Sparrow, band No. 42-169085, had a rectrix plucked at 2 p. m.; 29 days later, the bird returned with a succeeding feather showing a dark tip of half the normal width, showing daytime growth. Song Sparrow No. 42-169087 had a tail feather removed at 5 p. m. and five days later entered the trap with a partially grown feather with a full-width tip of light bar, of wholly nocturnal development.

It has been stated that the difference in color between the dark and light bars may be due to a more rapid development of the barbules during the day, hence more of them in a given space. Comparisons with a calibrated microscope were made, using the same vane for both counts in several species of birds. Numerous counts of 13 species of birds gave the same average of 21 barbules in a space of 250 microns of each of the dark and light growth bars, the greatest divergences being in the Goldfinch, *Spinus t. tristis*, counting 37 in the light and 31 in the dark bar, and the Purple Grackle with 25 in the light and 30 in the dark bar. The distal barbules with hooklets averaged about two more barbules than the proximal barbules which have no hooklets.

In most birds examined, the diurnal and nocturnal bars were about equal in width, but in the Black Duck, *Anas rubripes*, and the Yellow-billed Cuckoo, *Coccyzus a. americanus*, the dark bar was three times the width of the nocturnal. The Robin's light bar was about two-thirds the width of the dark bar produced during the Robin's prolonged feeding period. The Screech Owl has a light bar twice as broad as the dark. The width of the bars has no relation to the size of the bird but doubtless indicates the amount of food ingested and the length of the feeding period, as the broader the dark bar the more lipochromic nutrient granules it contains.

The angulation of growth bars is that angle subtended by the bar to the proximal rachis. The angulations in the 400 feathers measured with a protractor varied from 45 to 90 degrees. The angle is definite and constant for a species; it varies with the species. In most species it is constant for all feathers showing bars, but in a few feathers it varies slightly with the tract, and sometimes the basal end of a feather has slightly more acute angles than does the central area. All feathers from a single tract have the same angle. Glegg (1945: 303) said the bars are more or less at right angles to the shaft; other writers used the expressions "transverse" or "across the web." Michener and Michener in their illustrated report on the House Finch, *Carpodacus m. frontalis*, in California, wrote that the angles are "somewhat less than 90 degrees."

The angulation is difficult to determine correctly in narrow vanes and is obscure in many indistinctly barred feathers. It is most readily measured in the wing and tail feathers. In a few birds there may be found variations between tracts, as in the Mourning Dove with secondaries showing 85 degrees, axillars 77, and upper tail-coverts 75.

The constancy of the angulation according to species, of an individual tract, is shown by the fact that 12 Starling remiges each measured 77 degrees; 20 Robin rectrices measured 74 each; Purple Grackle

rectrices, 75; remiges from 26 Purple Grackles, 63 each; 20 Junco rectrices about 71; 20 White-throated Sparrow, *Zonotrichia albicollis*, rectrices, 72 each; 44 Great Horned Owl remiges, about 62 each; and 10 Cardinal rectrices, 77 degrees. It was also shown by 32 varieties of prize chickens; each measured 72 degrees.

The angles in degrees in 850 measurements of 84 species of birds were mostly from the 60's to the low 80's. There is an apparent grouping within certain limits. As a general thing, the finches are between 85 and 95 degrees, and the warblers in the lower 80's. These are followed by the ducks ranging from 68 to 75 degrees and the hawks from 65 to 74 degrees. A notable group of individual birds gave the following measurements, all of rectrices: Kingbird, *Tyrannus tyrannus*, Crested Flycatcher, *Myiarchus c. boreus*, Phoebe, *Sayornis phoebe*, and Wood Pewee, *Contopus virens*, each measured exactly 70 degrees; Robin, 74; Wood Thrush, *Hylocichla mustelina*, 76; and Hermit Thrush, *Hylocichla g. faxoni*, 75; Crow, *Corvus b. brachyrhynchos*, and the Raven each measured 68; Flicker, *Colaptes a. luteus*, was 72; and the Downy Woodpecker, *Dendrocopos p. medianus*, measured 71 degrees. Some species placed close together in the A. O. U. Check-List showed interesting comparisons in angulation: Nighthawk, *Chordeiles m. minor*, 74 degrees, and the Chimney Swift, *Chaetura pelagica*, about 82; the Chickadee, *Parus a. atricapillus*, has 90 while the Tufted Titmouse, *Parus bicolor*, has 75 degrees; the White-breasted Nuthatch, *Sitta c. carolinensis*, was distinctly 89 degrees; the Mockingbird averaged about 77, with the Catbird, 79, and the Brown Thrasher, 82 degrees.

Growth bars, by their widths, indicate the rate of growth of feathers and the regularity of feeding with its relative consumption. Their angulation is generic and tends towards familial characters. An examination of growth bars will aid in the identification of individual feathers. The various aspects of growth bars at least deserve more attention than has been accorded them by ornithologists.

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THE SPECIES—THEN AND NOW¹

BY DEAN AMADON

CHARLES DARWIN was particularly interested in speciation and taxonomy. This is evident both from the title he chose for his great work on evolution and from the monographs he wrote on the barnacles collected during the voyage of the *'Beagle.'* Although evolution had a prominent place in biology from the time of Darwin on, systematics has had a more checkered career. For many years new collections poured in so rapidly from all quarters of the globe that the harried taxonomist merely found time to publish brief Latin descriptions of new species or to puzzle over the endless questions of nomenclature. Meanwhile, laboratory genetics and related phases of biology advanced very rapidly, so rapidly that their results were not integrated with those of evolution or systematics.

This unfortunate state of affairs began slowly to improve a generation ago, but the rapid development of what is known as the "new systematics" has come in the last 15 or 20 years. Ornithologists played a prominent part in this movement, perhaps because birds are very well known taxonomically. As a result, the student of this group has been free to study such problems as variation within the species. A group of American ornithologists was among the first to call attention to such variation by the use of subspecific names. Long before the close of the last century Elliott Coues in his famous "Key" introduced such innovations as listing the Florida Jay as a race of the western Scrub or California Jay. Half a century was to pass before other ornithologists accepted this and similar proposals.

So long as the taxonomist was concerned primarily with supplying a name for each specimen to come before him, attention centered upon the individual specimen. When he began to study geographical variation, attention shifted from the individual to the population. Description of average or fluctuating differences became the order of the day. This point of view proved very enlightening, since speciation itself was found to be a process of gradual change in geographically isolated populations. Thus, the new systematics came into being when the taxonomist again became a student of speciation, just as Darwin had been. Today, he is aided by many discoveries in genetics, biometrics, and other fields that were not available to Darwin or his contemporaries.

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With the shift in emphasis from individuals to populations, the older morphological definition of the species became unsatisfactory. Some species were found to contain very distinct geographical populations which, nevertheless, interbreed and intergrade completely wherever they come into contact. In other groups, perfectly good species, which rarely or never interbreed, are so similar morphologically that it is difficult to separate them. The small American flycatchers of the genus *Empidonax* are an example, but still more extreme ones are provided by certain species of insects that are completely inter-sterile and yet so similar that they cannot be separated by ordinary taxonomic comparisons.

Although complete or nearly complete sterility is proof that speciation has occurred, the converse is not true. Sterility is often a more or less incidental result of the genetic drifting apart of two populations and is uneven in time and degree of appearance. Many species still capable of producing at least first generation hybrids are distinct enough to be placed in different genera by most taxonomists, and in at least one instance species now placed in separate families produce such hybrids (Guineafowl, *Numida meleagris*, by Domestic Fowl, *Gallus gallus*). When hybrids between two populations are less viable than either of their parents, natural selection may accelerate the appearance of sterility, or it may work to set up other isolating mechanisms to prevent crossing, such as differences in the breeding season or in courtship or mating behavior.

Among birds, differences in courtship are often important in preventing hybridization. The Mallard and Pintail, *Anas platyrhynchos* and *A. acuta*, for example, very rarely hybridize in nature, but under crowded or sexually unbalanced conditions in captivity hybrids are produced and these are fertile.

A somewhat similar situation may occur in nature when an individual of one species occurs as a rare straggler in the range of another. Lodge (1946: 72) has written of the re-introduced Capercaillie, *Tetrao urogallus*, in Scotland: "Sometimes capercaillie make sudden movements into fresh territory, and when this happens it is the females which move first, to be followed by the cock birds the next year. It is quite common to find that in the first breeding season in their new place they will mate with blackcocks [*Lyrurus tetrix*] and produce hybrids." A somewhat similar situation in two American grouse has been found by Baillie (1949: 167-168, and oral communication). Manitoulin Island, Lake Huron, was recently colonized by both Prairie Chickens, *Tympanuchus cupido*, and Sharp-tailed Grouse, *Pedioecetes phasianellus*. The latter occur in much smaller numbers

and, presumably as a result of their failure to find mates of their own species, a high percentage of the Manitoulin grouse thus far examined show evidence of hybridization.

In grouse the females come to the display grounds of the males and mating occurs with very little preliminary association between the sexes. Similar mating habits are responsible for the high incidence of hybrids in such families as the hummingbirds (Trochilidae) and birds of paradise (Paradisaeidae). The elaborate plumes and courtship performances of the males of these families, differing from species to species, doubtless have been molded through natural selection and prevent much hybridization, but they are not completely effective under all circumstances.

Hybridization by stragglers within the range of another species may occur even in birds in which mating is usually delayed for some time after pair formation. Nichols (1947: 172) has published information concerning a Cerulean Warbler, *Dendroica cerulea*, which was observed to build a nest and lay eggs near Lyons, New Jersey. "No male was seen and no young were hatched. It is probable that this female wandered far from the usual breeding grounds and, at the proper time, followed the normal nesting pattern but, of course, the eggs were infertile." Here hybridization did not occur, but it is easy to visualize how such an incident might favor it. It is quite probable that hybridization under such conditions produced Sutton's Warbler, *Dendroica potomac*, although one of the supposed parents, *Dendroica dominica* has not yet been found within the range of the other, *Parula americana*, in the relatively small area in West Virginia where Sutton's Warbler is believed to summer.

Making due allowance for such incidental hybridization as that discussed above, Mayr and others have defined the species as a population whose members *freely* interbreed with one another but do not do so with the members of other populations under natural conditions. In other words, a species is a sexually isolated population. There is no difficulty in deciding that the Mallard and Pintail or the Prairie Chicken and Sharp-tailed Grouse hybridize so infrequently in nature as to have no real effect on their deserved status as species. It seems improbable that the few genes of another species that might be acquired by such crossing (assuming fertility of the ensuing generations) would be of much importance. In some plants, however, such "introgressive hybridization," as it is called, is of importance. Sutton's Warbler may just possibly represent Yellow-throated Warblers in which some genes of the Parula Warbler have been acquired by hybridization followed by breeding back with Yellow-throated Warblers.

It is possible that even under natural conditions certain areas; in particular small islands, may rarely act as natural "cages" wherein two species elsewhere reproductively isolated hybridize to form an intermediate population and perhaps eventually a species. Some of the Galapagos finches of the smaller islands have an intermediate appearance and may have originated in this manner, although Lack (1947) is now inclined to doubt it and offers an ecological explanation. Subspecies circles such as those found in the Herring Gull group or the Old World *Parus major* group wherein the terminal links meet without interbreeding offer no particular difficulties. In other cases the reasons for geographical variations in the hybridizing behavior of two populations are more complex. The Eastern and Western Meadowlarks, *Sturnella magna* and *S. neglecta*, are said to interbreed in some areas but rarely, if at all, in others. Since the attainment of sexual isolation, even though it is the crucial step in speciation, is a gradual process, we cannot expect that it will occur simultaneously throughout populations that come in contact over long distances or in several different areas.

Enough has been said to indicate that it is not always easy to determine whether two populations interbreed freely, producing fertile hybrids, and hence belong to the same species. When morphological analysis indicates complete intergradation the burden of proof would seem to be upon those who maintain that two species are involved. The genetic basis of the variable characters will, in such cases, determine just how gradual the intergradation can be. The existence of differences in this respect is reflected in the concept once in vogue that species (may) hybridize but subspecies intergrade. As Miller (1949) has emphasized, there is no basic difference between subspecific and specific characters, either morphologically or in mode of inheritance. This idea was discarded along with the morphological concept of the species. Indeed, conspicuous characters, with a simple alternating mode of inheritance but often without any taxonomic significance at all, are found in color phases and other forms of polymorphism.

In certain populations of *Junco* discussed by Miller (1949) extensive hybridization occurs but is limited to a rather narrow zone not marked by abrupt ecological change. This, Miller considers to be an indication that hybridization is not undertaken freely or that the hybrids have reduced fertility or viability. Regardless of whether we agree with him that it is best to call these populations species, careful study of such cases is needed. This may help us determine whether differentiation in populations which have always been in contact does, with

any regularity, proceed on to speciation or whether a period of complete isolation is required. Certainly many of the species which now meet and hybridize to a limited extent were once completely isolated. They may be brought into contact again either by natural phenomena such as the melting of glaciers (Rand, 1948) or by man-made changes such as deforestation or irrigation.

The Yellow and Red-shafted Flickers, *Colaptes auratus* and *C. cafer*, interbreed freely over a wide zone wherever their ranges come into contact, and it is easy to visualize circumstances under which their differences could be entirely swamped out. It has been suggested to me that they are species whose courtship patterns happened to remain identical, permitting free hybridization. This, in itself, would conflict with the biological concept of the species.

This concept is sometimes interpreted to mean that "biological" (non-morphological) differences between populations, such as those in voice, habits, etc., assume added significance. This is true only to the extent that such differences act as isolating mechanisms and keep populations from interbreeding. Biological differences are often found in populations not even subspecifically distinct. The real criterion is that a species must be effectively isolated reproductively, not that it must possess any particular level of differentiation in either morphological or non-morphological characters. If one considers the birds of a single region, this reproductive isolation of species is one of their most obvious characteristics and gives them an objective reality not possessed by any other taxonomic category. It is only when we consider species in the process of segmenting geographically into new races and species that difficulty is sometimes encountered in deciding whether speciation has been completed.

The above remarks are not meant to minimize the importance of differences in voice or behavior to the taxonomist, particularly in difficult genera such as the American flycatchers. If interpreted with discretion, behavior data are perhaps even more helpful at the level of genus or above, as shown by such contributions as that of Delacour and Mayr (1945) on the classification of the waterfowl.

Thus far we have considered forms whose ranges come into contact at least marginally. Mayr (1948) is of the opinion that subspeciation and speciation in sexually reproducing animals always requires geographical isolation, and in the vast majority of cases isolation must be complete or almost complete to permit differentiation to proceed beyond the subspecific level. We thus have the near paradox that although breeding behavior in nature is usually the only test of specific status, a great many forms whose status is doubtful do not

occur together. We can then only study the amount of variation in the group in question and decide arbitrarily whether a particular isolated form is best considered a species or a race. There is no way of *proving* whether the Ipswich Sparrow, *Passerculus princeps*, of Sable Island is a race of the mainland Savannah Sparrow, *P. sandwichensis*. Although as a rule relationships are perhaps best expressed by listing geographical representatives as subspecies whenever possible, great caution must be used in difficult genera containing many similar species. On such grounds one may seriously question Hellmayr's decision that the Northwestern Crow, *C. caurinus*, is a race of the Fish Crow, *C. ossifragus*, or that the American Crow, *C. brachyrhynchus*, is a race of the European Carrion Crow, *C. corone*.

Exceptions to the above statements are provided by related forms proved to be sterile or nearly so by breeding experiments. So far as birds are concerned, this has rarely been demonstrated except for forms so distinct their specific status is scarcely open to question. This is true of the Wood Duck, *Aix sponsa*, and the Chinese Mandarin *A. galericulata*, but their failure to produce fertile eggs from matings in captivity was a surprise, in view of the many hybrid waterfowl known from less closely related parents. Yamashina's cytological studies have now shown that this sterility in the genus *Aix* is due to incompatibility of the chromosome sets of the two species, a condition that arose, perhaps more or less by accident, during their long period of complete isolation.

This discussion has sought to emphasize the important part played by ornithologists in the development of the modern species concept and the present status of this concept. The contribution to the new systematics of those not primarily ornithologists has been mentioned only casually. Needless to say, the taxonomist working with birds will be greatly aided both in the planning and interpretation of his work by maintaining a measure of familiarity with the systematic aspects of genetics, cytology, embryology, serology, and other fields of biology. The non-taxonomist will probably find comfort in the emphasis in recent studies of speciation upon aspects of behavior and ecology that can only be answered by field studies of living birds and on the tendency to de-emphasize the subspecies which has followed the realization that almost every population or segment thereof can be shown by careful analysis, statistical or otherwise, to possess some "subspecific" characters.

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THE FLIGHT MECHANISM OF SWIFTS AND HUMMINGBIRDS

BY D. B. O. SAVILE

DESPITE the considerable lapse of time since Westover (1932) showed by cinephotography that the Chimney Swift, *Chaetura pelagica*, beats its wings in unison, the illogical supposition that it may beat them alternately tends to persist. Aymar (1938) seemed frankly skeptical of the photographic evidence. Even Peterson (1947), although granting the evidence, tempered the term illusion by "at least." Recently, Storer (1948) included photographs showing synchronous beats, but said that "at times the chimney swift seems to beat its wings alternately, at other times simultaneously," leaving the reader in some doubt as to whether he considered the alternate wing beat illusory or real.

Several years ago, although it was realized that flight with alternating beats was a virtual impossibility because in a uniform medium the bird's body would oscillate strongly about its longitudinal and vertical axes, I watched Chimney Swifts stroboscopically in order to secure further evidence. A simple, clockwork, rotating shutter was arranged to cover the right objective of a pair of binoculars. By watching birds in direct flight toward or away from me and by closing the left eye, it was often possible with some practice to "stop" the wings for two or three beats, which was ample to show that they moved in unison. Actually, after about two months of almost daily observation, it was found that an increased ability to analyze motion allowed all but the most complex evolutions to be followed without the stroboscope. There is no doubt that the Chimney Swift, like all other birds, may stall one wing in a short turn and may use beats of unequal strength in various manoeuvres; but I could see not the slightest suggestion that in normal flight it ever uses anything approaching an alternate beat.

The illusion seems to be explainable largely upon the following facts. The wings of the Chimney Swift are heavily pigmented and are thus somewhat more readily visible in motion than those of many birds of comparable size. They beat just slowly enough to be observed with some difficulty; if they beat half as fast their motion would be obvious, if twice as fast they would be invisible. All who have watched the Nighthawk, *Chordeiles minor*, will recollect the manoeuvre by which it takes an insect that is just off its line of flight. If the insect is to its left it banks to the left, swings in that direction and then, after the strike, usually banks and turns back to its original course. The

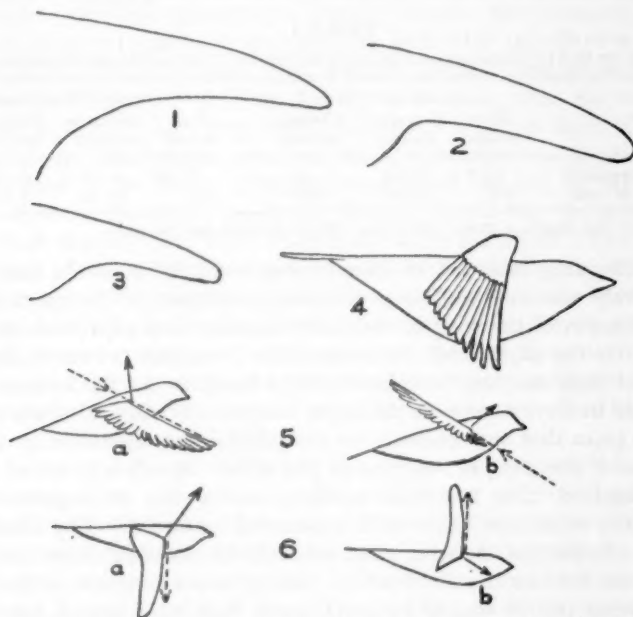
Chimney Swift does this same trick very frequently, but does it much faster because of its small size and weight. Thus the observer sees the wings stilled for a fraction of a second, one up and one down, and then, after a beat or two, the reverse. I believe that misinterpretation of this action which, although fast, is much slower than the wing beats is responsible for many of the claims of alternate beats.

Perhaps the illusion has been fostered also by the feeling that there must be something unusual about the flight of the swifts as a group to account for their proverbial speed. It may, therefore, be profitable, if only to aid in laying the bogey, to inquire into their flight mechanism. To do so it will be helpful if we consider the swifts with the related hummingbirds whose speed of flight is not merely an illusion engendered by their small size.

First it must be emphasized that both the Ruby-throated Hummingbird, *Archilochus colubris*, and the Chimney Swift, which will be used as examples of the two families, possess in high degree what may be termed the high-speed wing; it is thus almost inevitable that they should be fast fliers. The general characteristics of this wing (Fig. 1) are: pronounced sweepback of the leading edge and sometimes also of the trailing edge; gradual taper to an elliptical tip; relatively slight camber; and a conspicuous fairing at the junction of the trailing edge with the body. In much the same outward form, but with considerable structural differences, this type of wing has been independently evolved in several groups of birds including the ducks, falcons, plovers and sandpipers, swifts and hummingbirds, and swallows. Figure 1 approximately represents the wing of the Golden Plover, *Pluvialis dominica*, and will serve as a typical, well developed, high-speed wing. Figures 2 and 3, which are not to scale, show the wing plans of the Chimney Swift and the Ruby-throated Hummingbird. The sweepback is pronounced and each wing possesses a large fairing of rather unusual form. The only conspicuous difference between them is that the hummingbird's wing is disproportionately short, which is to be expected in a very small bird. Thus both birds have the form of wing demanded by fast flight, and the wings possess further peculiarities that emphasize the birds' relationship.

There is reason to believe that in most birds in level flight the wing is "feathered" (in the oarsman's sense) during the up-stroke; that is to say, the stroke is more or less neutral, producing the minimum of thrust or drag. This effect is achieved in several ways: 1) the wing is partly folded by bending backward and slightly downward at the wrist to reduce its area; 2) the webs of the primaries separate from each other to allow the passage of air; 3) the camber of the wing comes

into play; and 4) the wing is raised with the leading edge highest so that the air stream and the elevating muscles tend to combine in raising it (Fig. 4). That little power is exerted on the up-stroke in many birds is indicated by the relatively small size of the elevating muscles. Thus the elevating muscles of an American Robin, *Turdus migratorius*, weighed little more than a tenth as much as the depressing muscles and only 1.6 per cent of the weight of the bird (Table 1). In contrast, the elevating muscles of the Ruby-throated Hummingbird are relatively enormous, nearly one-half the weight of the depressing muscles which are also large. In hovering, the up-stroke (now directed largely backward) must do work. The down-stroke, with its pronounced forward element, inevitably supplies some backward thrust with the lift, and the up-stroke supplies a counterbalancing



FIGURES 1-6 (not to scale).—1) Plan view of typical high-speed wing; 2) Plan view of wing of Chimney Swift; 3) Plan view of wing of Ruby-throated Hummingbird; 4) Typical, neutral up-stroke, probably used in most birds other than swifts and hummingbirds; 5) Wing-action in hovering: (a) down-stroke, (b) up-stroke. Broken arrows show direction of wing movement; solid arrows show approximate size and direction of resultant force acting on bird; 6) Probable wing-action of swifts and hummingbirds in level flight: (a) down-stroke, (b) up-stroke. Symbols as in Figure 5.

forward thrust together with additional lift (Fig. 5). Moreover, there is no appreciable air stream to aid the up-stroke.

If a bird uses a powered up-stroke in level flight, the down-stroke will supply forward thrust and the lift necessary to maintain altitude, whereas the up-stroke will supply only forward thrust (together with some inevitable negative lift, which must be counted as a loss). Such action is shown in Figure 6. For the two strokes to supply equal thrust it is plain that the up-stroke need not consume nearly as much power as the down-stroke. If the hummingbird utilizes its elevating muscles as fully in level flight as in hovering, it may well be that the up-stroke supplies nearly as much forward thrust (not total power) as the down-stroke. For such a mechanism to be effective the wing must not have its flight feathers separated and must not bend at the wrist, as described earlier, but must remain relatively rigid. Further-

TABLE 1

WEIGHTS OF BREAST MUSCLES OF AMERICAN ROBIN AND RUBY-THROATED HUMMINGBIRD

	American Robin			Ruby-throated Hummingbird		
	Total weight	Depressor muscles	Elevator muscles	Total weight	Depressor muscles	Elevator muscles
Weight (grams)	72.5	10.01	1.15	2.49*	0.51	0.23
Percent of total	100	13.90	1.60	100	20.50	9.25

* Weight after dissection, 30 hrs. after death. Weight at death was 2.93 grams.

more, the wing must not be strongly cambered, for it would then be negatively cambered and proportionately inefficient on the up-stroke. Examination of the wing of the Ruby-throated Hummingbird shows that both the shafts and the webs of the primaries are surprisingly rigid for their size and that there is little tendency for the feathers to separate under pressure on the upper surface. It may also be noted at this point that any tendency for the primaries to separate is greatly lessened if the wing is not bent at the wrist. As already noted the hummingbird wing has little camber, and it may be regarded as eminently suited for flight with a powered up-stroke. The aerodynamic efficiency of the wing must certainly be somewhat lower on the up-stroke than on the down-stroke, but there is no known method of calculating it. It should be emphasized that wind-tunnel tests in which the wing is treated as a rigid airfoil give so untrue a picture of the performance of a bird wing as to be virtually useless. We can only guess what proportion of the thrust can be supplied by a powered up-stroke, but it may well be over 25 per cent.

Now let us consider the Chimney Swift in the light of this proposed flight mechanism. As in the hummingbird, the shafts and webs of the

outer primaries are relatively stiff. Some further stiffening is provided by the marked backward curve of the distal parts of the shafts of the three outermost primaries, which tends to keep all the outer shafts close together.

The weak part of a wing that is to be held rigid on the up-stroke is the wrist. At first glance this fact might be considered an argument against a powered up-stroke in the Chimney Swift, for the arm bones are very short, which brings the wrist in toward the base of the wing and the bending moment on it (considering the wing as a uniformly loaded cantilever) is thus considerably increased. If the Chimney Swift's wing is compared with the superficially similar one of the Tree Swallow, *Iridoprocne bicolor*, which has nearly the same overall length, it will be found that the upper arm and the forearm of the swift are roughly half the length of the swallow's, whereas the hand is slightly longer. Further consideration shows, however, that humerus, radius, and ulna are remarkably heavy in the swift, that the elbow is capable of very little movement, and that the wrist, although sufficiently flexible horizontally to allow folding of the wing when the bird is at rest, is massive and very rigid vertically. A heavy sheet of tendon runs over the forearm and over the top and front of the wrist and attaches to the hand. Tendons so situated are not by any means confined to the swifts, but in the Chimney Swift they are much more robust than in other small birds that I have examined. The amount that a tendon will stretch under a given load is clearly proportional to its length. The shorter the arm bones, and consequently the tendons, the less will be the sagging of the wing on the up-stroke, for the power will be transmitted to the hand largely through these tendons. It appears that the swift's wing will be locked rigidly at the wrist on the up-stroke and that its peculiar structure may have evolved because of its value in this mode of flight.

In point of fact, few will deny the comparative rigidity of a swift's wings in flight. It is this rigidity, in contrast with the fluidity of a swallow's wing beats, that cause the swift's flight to be labelled as jerky or flickering. How much power may be applied in the up-stroke is a matter of conjecture. I do not have available the weights of the breast muscles of the Chimney Swift, but the conspicuously large keel in this species, and in the family generally, provides ample room for the attachment of large elevating muscles such as are found in the Ruby-throated Hummingbird.

It is my opinion that the flight mechanism of both swifts and hummingbirds involves a powered up-stroke, which is an appreciable factor in their speed of flight.

SUMMARY

A stroboscope supplied further evidence that the wing beats of the Chimney Swift are always synchronous, never alternate. The illusion of alternate beats is partly due to the bird banking alternately to right and left, as it veers in pursuit of an insect, and then resumes its course. The flight mechanism of the swifts and hummingbirds is suggested as utilizing a powered up-stroke, supporting evidence being drawn from the large elevating muscles, the wing structure and the appearance in flight.

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6 Oakland Ave., Ottawa, Canada, December 30, 1949.

GENERAL NOTES

The Mexican Grebe, *Colymbus d. brachypterus*, at Baton Rouge, Louisiana.—Late on the afternoon of December 14, 1947, the writers caught a glimpse of a Mexican Grebe as it dove beneath the surface of Capitol Lake, not 20 feet from the shore. Though we were both familiar with the species as a result of our work in Mexico, we were so unprepared for the discovery that we could not immediately convince ourselves of the bird's identity. Lowery collected it, a male, weighing 131.8 grams, with testes measuring 2.5 by 4.5 mm. (Louisiana State Univ. Mus. Zool. No. 10604).

Capitol Lake is situated within the city limits of Baton Rouge, adjoining the park-like grounds of the present statehouse. It still appears on many maps as University Lake, a name that dates back to the days when the State University was located not far from its shores, and one that causes it to be confused with the larger body of water, sometimes called New University Lake, near the present site of the campus. Capitol Lake is about 80 acres in extent and has firmly banked edges, nearly devoid of aquatic vegetation.

The fourth edition of the A. O. U. Check-list (1931) gives the range of the Mexican Grebe in the United States simply as "southern Texas." It has been observed in that state as far north as Bexar County and as far east as Rockport, occurring as a permanent resident at both places. Either locality is more than 350 miles from Baton Rouge. Since the record is unprecedented and since the species occurs also in Cuba, only about 700 miles from Baton Rouge, it was by no means a foregone conclusion that our bird was of Texan origin. Accordingly, its identity was checked very carefully. Its measurements are as follows: chord of wing, 86 mm.; culmen from base, 23.8; tarsus, 31. The latter two measurements are large enough to fall well within the range of variation in a series of eight West Indian males, as given by Wetmore (Proc. U. S. Nat. Mus., 93: 230-231, 1943). But the short wing, the very white underparts, and the light sides and flanks definitely place it with the geographically nearest race, *brachypterus*, of Texas, Mexico, and Central America.

The observation in Louisiana of birds whose breeding ranges lie entirely to the west of the state's westernmost meridian is a commonplace occurrence, involving at least 49 forms (McAtee, Burleigh, Lowery, and Stoddard, Wilson Bull., 56: 152-160, 1944). But the overwhelming majority of such birds also breed north of the state's northernmost parallel and appear in Louisiana in autumn and winter. They are, in other words, southbound migrants, and the cause of their presence to the east of their points of departure may be sought in some factor associated with fall migration. One such explanation is suggested by the apparent correlation between air trajectories and nocturnal migration (Lowery *in press*) and the fact that the winds of autumn and early winter often sweep into Louisiana out of the northwest. Instances of individuals that have proceeded in the opposite direction, from a southwestern breeding range toward the northeast, are extremely rare; and among them the case of the Mexican Grebe is practically unique in that it concerns a supposedly non-migratory species, of seemingly weak flight-power, so constructed that a forced landing on the ground would confront it with disaster. The Daily Weather Maps (U. S. Weather Bureau) for November and December, 1947, reveal no unusual meteorological conditions that could clearly account for the sort of displacement involved. In view of the fact that Baton Rouge is not, after all, a great deal farther north than Bexar County, Texas, one cannot help wondering whether a few pairs of Mexican Grebes may not be spending their lifetimes unnoticed in the vast reaches of the Louisiana

marshland.—GEORGE H. LOWERY, JR., AND ROBERT J. NEWMAN, *Museum of Zoology, Louisiana State University, Baton Rouge, Louisiana.*

First Ontario Specimen of the Eared Grebe, *Colymbus caspicus californicus*.—Among a number of waterfowl which met death by being carried over Niagara Falls, an Eared Grebe is of particular interest since it now represents the first preserved specimen of this species from Ontario (R. O. M. Z., No. 77014). The bird was found on February 6, 1950, on the Ontario side of the Niagara River below the Falls by Mr. Roy Muma, Conservation Officer of the Ontario Department of Lands and Forests. It was somewhat emaciated but the plumage was in good condition. It is a female and is, except for a few coverts on the left wing which are worn and brownish, in fresh winter dress.

Reference to the inner primaries discloses the specimen to be typical of the western American race *californicus*. The dorsal area is essentially black, with no trace of pale tips on the feathers. The lores, crown, sides of head, hind neck and the terminal portion of the side and flank feathers are blackish. The chin and throat are greyish white, the foreneck and sides of neck are dusky, the breast and belly silvery white. The specimen measured 315 millimeters in length and 540 in wingspread. The culmen, 24 millimeters in length, is broader than high at the base and has a slight depression in the outline of the culmen at the center.

Previous records for Ontario are as follows: The first concerns one examined in the flesh, but not preserved, by Dr. [J. H.] Garnier. It was taken at Colpoy's Bay, Bruce County, Ontario, prior to 1886 and was recorded by T. McIlwraith (Journ. and Proc. Hamilton Assoc., 1885-86: 47). The second is a sight record of a pair on April 28, 1948, at Carroll's Point, Hamilton Bay, by George North and recorded by James L. Baillie, Jr. (Aud. Field Notes, 2: 174).—L. L. SNYDER AND C. E. HOFER, *Royal Ontario Museum of Zoology, Toronto.*

Observations on the Food Habits of the Double-crested Cormorant, *Phalacrocorax a. auritus*.—Buchheister (Aud. Mag., 46: 14-25, 1944) and Gross (Auk, 61: 513-537, 1944) have remarked on the increased populations in recent years of the Double-crested Cormorant along the North Atlantic coast of the United States. Such an increase has also been obvious to marine fishermen who claim that the birds are a threat to the fishing industry. As a result of many requests from operators of herring weirs and herring seiners, control methods were initiated in 1944 by the U. S. Fish and Wildlife Service and the Maine Department of Inland Fisheries and Game. Later, the Maine Department of Sea and Shore Fisheries also cooperated in the effort.

Recently, I have been engaged in an investigation of the herring industry in Maine and have had the opportunity to hear about the "depredations" of this bird. In the minds of marine fishermen, the cormorant is obnoxious for several reasons. They believe that the bird's swimming and feeding activities within weirs or pound nets may disturb the impounded herring schools, and the fish may try to escape from the fishing apparatus. When the fish are held in a seine, there is no easy way of escape; but in a weir, the school may rush out of the entrance, if such has not yet been closed. They also claim that the birds consume enormous quantities of commercially important fish. It is interesting to observe that similar charges of maleficence are made against the hair seal, *Phoca vitulina*, in Maine.

Mendall (Univ. Maine Studies, Sec. Ser., 38: iv-159, 1936) summarized the available data on the food habits of the Double-crested Cormorant and concluded that only a small part of the bird's food was commercially important species. His examination in 1935 of a large series of regurgitated meals revealed that unimportant scrap

fish were the primary food of this bird. His conclusions at the time were that the species does little if any damage to man's interest but that local control would be necessary where interference with net fishing became pronounced. At the time of Mendall's report, the cormorant was perhaps not as common a visitor as it is today to herring weirs and places where herring are impounded in seines.

A comprehensive study of the year-around food habits of this species has still to be made to obtain an estimate of the total amount of commercial fish consumed during the year. In the past few years, I have had the opportunity to examine stomach contents of 40 cormorants, both in Maine and Florida. At the times the stomachs were collected in Maine, there were no impounded herring in the vicinity.

The following stomach contents are from birds collected in the region of Outer Heron Island, White Islands, and Pumpkin Island off Boothbay Harbor, Maine, on August 31, 1944. All measurements refer to total length.

Stomach no. 1, one Atlantic herring, *Clupea harengus*, 201 mm.; no. 2, one rosefish, *Sebastes marinus*, about 60 mm.; no. 3, three shorthorn sculpins, *Myoxocephalus scorpius*, about 40, 55, and 80 mm.; no. 4, three cunners, *Tautoglabrus adspersus*, about 50 mm. each; no. 5, empty; no. 6, two Atlantic herring about 95 and 120 mm. and a few unidentified fish bones; no. 7, one small pleuronectid about 55 mm. and one gunnel, *Pholis gunnellus*, about 70 mm.; no. 8, one shorthorn sculpin about 70 mm.; no. 9, one cunner, 110 mm., two rosefish about 80 mm. each, and one winter flounder, *Pseudopleuronectes americanus*, 78 mm.; no. 10, one cunner, 171 mm., and one rosefish about 40 mm.; no. 11, one winter flounder, 91 mm.

The following stomach contents were collected October 2, 1944, at Boothbay Harbor, Maine:

Stomach no. 12, two shrimp, *Spirontocaris* sp.; no. 13, eight cunners, sizes not ascertained; no. 14, one longhorn sculpin, *Myoxocephalus octodecimspinosus*, about 135 mm., two gunnels about 50 and 65 mm., and one cunner about 40 mm.; no. 15, a few unidentified fish bones.

On July 22, 1947, the following stomachs were collected in the region of Outer Heron Island, White Islands, and Pumpkin Island, Maine.

Stomachs no. 16, 18, and 19 empty; no. 17, one Atlantic herring, 120 mm., and a few unidentified fish bones; no. 20, one gunnel, 101 mm.

On May 12, 1949, the following nine stomachs were obtained at Little White Island, Maine:

Stomach no. 21, empty; no. 22, one cunner, 95 mm.; no. 23, remains of three longhorn sculpins; no. 24, three cunners, 101, 173 and 179 mm. and remains of one small rosefish; no. 25, remains of two longhorn sculpins; no. 26, empty; no. 27, one alewife, *Pomolobus pseudoharengus*, 222 mm.; no. 28, seven American eels, *Anguilla bostoniensis*, 176, 180, 193, 202, 207, 222 and 228 mm.; no. 29, one alewife, 230 mm.

On May 18, 1949, the following six stomachs were collected at the same locality:

Stomach no. 30, one winter flounder, 177 mm.; no. 31, one sea raven, *Hemirhamphus americanus*, 198 mm.; no. 32, remains of one cunner, 183 mm.; no. 33, two shorthorn sculpins, 172 and 184 mm.; no. 34, remains of two cunners; no. 35, remains of one alewife.

In Santa Rosa Sound, Pensacola, Florida, the following stomachs were obtained between March 17 and 30, 1948:

Stomach no. 36, two pinfish, *Lagodon rhomboides*, 70 and 72 mm.; no. 37, six pinfish, 58, 61, 62, 81, 96 and 110 mm.; no. 38, seven pinfish, 70, 82, 88, 101, 112, 113 and 135 mm.; no. 39, one sea catfish, *Galeichthys felis*, 110 mm., one common sea robin,

Prionotus carolinus, 228 mm., and two toadfish, *Opsanus tau*, 101 and 190 mm.; no. 40, one striped mullet, *Mugil cephalus*, 242 mm.

During the summer of 1949, the Little White Island rookery was visited twice and examinations were made of the regurgitations of the young birds. The data are shown in Table I.

TABLE I
REGURGITATED MATERIAL AT CORMORANT ROOKERY, WHITE ISLANDS, MAINE

Species	July 7			August 6		
	Num- ber	Per cent of total num- ber	Total length (milli- meters)	Num- ber	Per cent of total num- ber	Total length (milli- meters)
Cunner	13	19.4	76-178	87	28.5	50-200
Silverside, <i>Menidia notata</i>	—	—	—	100	32.8	45-110
Gunnel	16	23.9	57-178	34	11.1	60-190
Rosefish	6	9.0	76-127	35	11.5	52-130
Winter flounder	14	20.9	75-152	13	4.3	80-160
Butterfish, <i>Poronotus triacanthus</i>	3	4.5	— ¹	22	7.2	90-160
Pollack, <i>Pollachius virens</i>	7	10.4	152-241	2	0.7	120-130
Wrymouth, <i>Cryptacanthodes maculatus</i>	3	4.5	254-267	2	0.7	— ¹
Longhorn sculpin	—	—	—	4	1.3	65-160
Mackerel, <i>Scomber scombrus</i>	—	—	—	3	1.0	150-200
Herring	1	1.5	127	1	0.3	242
Radiated shanny, <i>Ulsaria subdifurcata</i>	2	3.0	89-114	—	—	—
Eelpout, <i>Macroscoptes americanus</i>	—	—	—	2	0.7	140-300
Alewife	1	1.5	114	—	—	—
Shorthorn sculpin	1	1.5	83	—	—	—
Total	67			305		

¹ Specimens too disintegrated for accurate measuring.

Among the 15 species of fish recorded from the stomachs and regurgitations of cormorants in Maine, the rosefish, winter flounder, pollack, butterfish, herring, mackerel and alewife are commercially important. Some of the individuals of the latter four species were large enough to be marketed, but the small sizes of the other three would prevent their commercial utilization. Of the five species of fish from Florida birds, only the striped mullet is of importance as a food fish in that region.—LESLIE W. SCATTERGOOD, *United States Fish and Wildlife Service, Boothbay Harbor, Maine.*

Old Record of *Anhinga anhinga* Taken on St. Mary's River, Ontario.—There are several references in the literature (see Butler, 1898, 'The Birds of Indiana'; Barrows, 1912, 'Michigan Bird Life') to an *Anhinga* collected at Sault Ste Marie, but for lack of substantiating details the record has been largely disregarded.

In November, 1936, the University of Michigan Museum of Zoology received in exchange from the Cincinnati Society of Natural History an adult female *Anhinga* (now U. M. M. Z. No. 91960). The specimen has an old label in Charles Dury's hand, which reads: 'Snake Bird' ♀ / *Anhinga anhinga* / Sault Ste Marie, Mich. / Given me by / Patrick E. Roach / the year the canal / was finished at Ste.

Ralph Dury, present Director of the Cincinnati Museum of Natural History, writes me that his father, Charles Dury, was Curator for the Cuvier Club and prepared their bird specimens. Patrick Roach was a member of the Club and contrib-

uted to their collection a number of birds from widely scattered localities in the United States. The collection was later deposited in the Cincinnati Museum of Natural History.

In a letter to Norman A. Wood in 1926, Charles Dury stated that Roach was one of the firm of contractors that built the first lock, which was finished and opened for traffic September 1, 1881. Roach had purchased the specimen at the time it was collected and brought it to Dury for identification.

In 1936 I corresponded with M. J. Magee at Sault Ste Marie concerning the record. Magee consulted Judge Joseph H. Steere, an elderly amateur ornithologist of Sault Ste Marie who knew about the specimen. Judge Steere said that an Indian had shot the Anhinga at Garden River, Ontario (12 miles down the river from Sault Ste Marie), "about 1881" and brought it to a saloon in Sault Ste Marie, where the Judge examined it and where it was identified by "a captain at Fort Brady" who had seen Anhingas in Florida. The Judge was not then familiar with the species, but he later came to know it in the south and recalled the Garden River specimen.

The St. Mary's River is not very wide at Garden River, and the bird could presumably have been taken on either side of the International Boundary line; the evidence, however, is in favor of Ontario. At any rate, there seems to be no reason to doubt the authenticity of the record. The Anhinga occurs regularly north to Reelfoot Lake in northwestern Tennessee and was formerly found in southern Illinois. L. L. Snyder (Contrib. Royal Ont. Mus. Zool. No. 19: 28-29, 1941) has recorded an Anhinga taken near Wellington, Prince Edward County, Ontario, September 7, 1904. There are also two reports of this species from Wisconsin, but neither is wholly satisfactory (see Bull. Wis. Nat. Hist. Soc., 2: 109-112, 1902; Auk, 29: 398, 1912). I am indebted to L. L. Snyder, of Toronto, and J. L. Diedrich, of Milwaukee, for information on these records.—JOSSELYN VAN TYNE, *University of Michigan Museum of Zoology, Ann Arbor.*

The Man-o'-war-bird, *Fregata magnificens*, on the Coast of Surinam, Dutch Guiana.—In the account of the bird life on the Atlantic coast of South America to the shoulder of Brazil, Murphy ('Oceanic Birds of South America,' 1936: 132) quotes the description by Young (Ibis, 1929: 751) from the coast of British Guiana between the Corantyne and Demerara rivers and lays stress on the absence of records of the Man-o'-war-birds from this region.

According to my observations during the last three years, the Man-o'-war-bird is of regular occurrence on the coast of Surinam, Dutch Guiana, in small numbers. Starting in the northwest of the country my list of records is as follows: (1) mouth of Nickerie River, which is only a few miles east of the mouth of the Corantyne River: March 6, 1946, two birds; March 9, 1946, one; July 23, 1946, 7; August 12, 1947, one; December 10, 1946, four birds. (2) coast near Coronie: July 10, 1946, one bird; September 11, 12, 1947, two; September 13, 1946, one bird. (3) tributary of Coppename and Saramacca rivers: March 15, 1947, one bird; June 5, 1948, one; July 8, 1946, one; July 11, 1947, one; September 10, 1947, one; September 14, 1946, six birds.

I do not know of any evidence that this bird breeds anywhere along this coast. On the other hand, my records prove that the Man-o'-war-bird is present during at least six months of the year, though I was not able to visit any likely localities during all months, so that my records do not prove any way that the birds are absent during other periods.—FR. HAVERSCHMIDT, *Paramaribo, Surinam.*

American Egret, *Casmerodius a. egretta*, Builds Nest in Massachusetts in August.—A remarkable incident in the great 1948 flight of egrets to New England was the building of a nest at South Sandisfield, Massachusetts. The date was mid-

August. Mr. J. Edward Hyde of Springfield, a professional motion-picture photographer, who happened to be spending the week-end at this Berkshire village on August 14-15, 1948, was able to record on color-film what skeptics would otherwise feel was "unproven." He built a blind in an adjacent tree and photographed the fitting in of stick after stick. The nest-builder was still wearing nuptial plumes at that very late date, but the partner who found and carried the sticks had shed these plumes, and one can only wonder what induced the latter bird to undergo this labor. The nest was to all appearances completed, but no eggs were ever laid. Incidentally, the film also shows a Snowy Egret, *Leucophoyx thula*, still richly plumed—the first indubitable record of occurrence of that species in Berkshire County.—SAMUEL A. ELIOT, JR., *Smith College, Northampton, Mass.*

The Black Duck, *Anas rubripes*, in North Dakota.—On August 3, 1948, the writers saw a female Black Duck with a brood of six half-grown young on the Upper Souris National Wildlife Refuge about two miles west of Grano, North Dakota. A search of the available literature disclosed that the brood was a first record for the state. This and two records in 1949 from the same locality are described here.

Although formerly of very rare occurrence (Wood, 'A preliminary survey of the bird life of North Dakota,' 1923: 16), the species has in recent years been frequently seen in North Dakota (Griffith, Auk, 64: 470-471, 1947) and also through the prairie provinces (Wright, 'The black duck in eastern Canada,' Unpubl. Master's Thesis, Dept. Wildl. Manag., Univ. Wisconsin, 1947). We believed that an inquiry into its migration, distribution, and relative numbers might explain the absence of prior observed nesting and certain vagaries of its appearance during the year.

Acknowledgment should be made to the following for their contributions: Brandt Hjelte and Roy Bach made available field transect data obtained by North Dakota wardens and Federal Aid men in 1948; Donald Vogtman, Jerome H. Stoudt, and Edward G. Wellein furnished waterfowl survey records of the Missouri River Basin Studies (1948), Research (1948), Game Management, and Refuge Branches of the Fish and Wildlife Service (1946 through 1948); the personnel at several National Wildlife refuges supplied banding and botulism records and observations from their respective localities dating back to 1936; William Marshall, William H. Longley, and Joseph J. Hickey reviewed and commented on the manuscript.

MIGRATION AND DISTRIBUTION

The information from all sources shows that Black Ducks are rarely seen with Mallards during spring migration in March, April, and most of May, but they become fairly common in some localities and widely scattered over the state about June 1.

They are usually first seen with small bands of male Mallards, and they appear with Mallards on the larger marshes during the flightless period. All of 39 Black Ducks sexed as botulism victims or in banding operations between 1936 and 1949 were males (including three flightless birds taken in a corral-type trap on the Lower Souris Refuge, July 13, 1948). It seems quite probable that the summer population may largely originate in eastern breeding areas. There must be a wide wandering of males, as there is of male Mallards, prior to the postnuptial molt. The scarcity of females explains the relatively few breeding records.

Fall movements have been discussed by Wright (*loc. cit.*, 106-108), who suggests that considerable distances are "traveled by flying young in their wanderings prior to the southward migration." This would ordinarily explain the occasional immature bird recorded at banding stations in September and through the fall. The autumn

population includes the summering males augmented by wandering young and adults that may have arrived from both the north and east.

RELATIVE ABUNDANCE

The numbers seen in the fall and winter have varied somewhat from year to year, due partly we believe to one or more conditions: (1) population changes on the eastern breeding grounds with corresponding changes in the numbers of birds involved in post-breeding movements; (2) variation in number of fall wandering birds and in the direction traveled because of weather or other factors; and (3) in some years an earlier or later exodus of summer birds from North Dakota marshes.

Ratios of Mallards to Black Ducks were broadly between 500 and 900 to 1 in the combined refuge records covering the summer and fall periods, 1936 to 1940, and between 100 and 300 to 1 for the combined refuge and state records covering the same seasons between 1941 and 1948. This suggests an appreciable increase through the latter period, since Mallards were likewise as abundant, or more so, during the latter period on the areas sampled.

For those who at some future time may wish to compare relative numbers with those present during the period sampled, these Mallard-Black Duck ratios are given.

Counts during April and May, covering the state mostly between 1946 and 1948, gave a ratio of 1345 Mallards to 1 Black Duck seen (5381 Mallards: 4 Black Ducks). During spring migration, 1949 (April and May) no Black Ducks were seen while the senior author and Grady Mann counted 2260 Mallards on and near the Lower Souris Refuge. In June the ratio was 150 to 1 (3610 : 24), counted on samples across the north-central portion of the state (1936 to 1948). With many females on the nest the Mallards seen were high in the proportion of males, but the real ratio would have been less than 300 to 1. July and August figures, largely from botulism and banding records on refuge marshes that served as gathering areas for both species, were 65 to 1 (2000 : 31). Male Mallards again predominated in the latter sample. For September, October, and November we will cite only the senior author's counts on Lower Souris and Upper Souris refuges, since the fall banding data were somewhat selective for Black Ducks. September ratio, 417 to 1 (5000 : 12); October ratio, 705 to 1 (7752 : 11); November ratio, 768 to 1 (13,059 : 17); November 15 to 21 ratio, 353 to 1 (3529 : 10). The November 15 to 21 increase in relative abundance of Black Ducks was due to a perhaps disproportionately high number remaining with those Mallards using the scattered winter open-water holes after the final freeze-up.

BREEDING

The brood of Black Ducks referred to in the first paragraph was under our binocular observation from a boat for about ten minutes at distances of less than 40 feet. The plumage characters of both female and young were typical of the species. The site was again visited by Hammond on June 6, 1949. Four Black Ducks were seen: two flew away from the shore together, possibly a pair; another, from its behavior, was a female mated with a male Mallard; and the fourth was a single bird. Carl Fermanich, Refuge Manager of the Des Lacs National Wildlife Refuge, Kenmare, North Dakota, recorded broods of seven and nine half-grown young, the first in the same locality and the other about four miles south, on July 29, 1949. It will be interesting to follow the success of this small breeding population through future years.

We learned that toward the last of May, 1940, Stanley Saugstad (Corres., 1948) saw a pair of Black Ducks on a 3 to 5 acre *Carex* marsh less than a mile from Lake Washington, an open-water lake about 20 miles east of New Rockford.

Of particular interest was a local gathering twice observed by Donald Vogtman (Corres., 1948 and 1949) at the channel separating the middle and east portions of Devils Lake. Here he counted 125 birds in November, 1948, and 150 on September 21, 1949. We believe that this was only a fall flock, but a breeding population may possibly be using the locality.

We do not know whether the rare breeding female migrates from southern wintering grounds in the spring or moves in from the east about June 1 when the males appear.—MERRILL C. HAMMOND AND EDWARD J. SMITH, JR., *Fish and Wildlife Service, United States Department of Interior, Upham, North Dakota, and Germfask, Michigan.*

On *Accipiter striatus suttoni* van Rossem.—In Number 4, Part 1, 13, of the 'Catalogue of Birds of the Americas' recently published, the name *Accipiter striatus suttoni* van Rossem was placed in the synonymy of *A. s. velox* with a note (p. 71) stating that none of the Mexican material in the Field Museum showed the characters of this race except an immature from Michoacan. At the request of Dr. George M. Sutton, I have just examined the type and four topotypes of this form. These birds are very different from anything in our collections except one specimen from the Huachuca Mountains in Arizona which is very like *suttoni*. They bear out Dr. Sutton's belief that the race is a very good one. Evidently all our Mexican examples, except the Michoacan specimen, are migrants.—BOARDMAN CONOVER, *Chicago Natural History Museum (Field Museum), Chicago, Illinois.*

Sparrow Hawk Pursued by Chimney Swifts.—As noted by Bent (U. S. N. M. Bull., 176: 284, 1940), the speed and erratic flight of the Chimney Swift, *Chaetura pelagica*, renders it almost immune to attacks by birds of prey. He cites one report of such an attack, however; a swift was seized by a Sharp-shinned Hawk just as it was about to drop into a chimney (Musselman, Bird-Lore, 33: 397, 1931). In view of the rarity of such occurrences any evidence that Chimney Swifts regard hawks as enemies seems to me to be worth reporting.

In downtown Washington, D. C., shortly after sundown on October 3, 1949, my attention was attracted by 40 or 50 Chimney Swifts pursuing a Sparrow Hawk, *Falco sparverius*. My first thought was that possibly they just happened to be going in the same direction, but then the hawk reversed its course and they promptly turned to follow, swarming around the hawk like mad bees. I was unquestionably observing a genuine pursuit which ended only when the hawk abruptly descended to land on the ledge of a building. It seems unlikely to me that the swifts would have taken after the hawk if they had not been molested or had not recognized the species as an enemy.—FRANK C. CROSS, 9413 Second Ave., Silver Spring, Maryland.

Red Ant Predation on Bob-white, *Colinus virginianus*, Chicks.—During nesting studies of the Interior Bob-white, *C. v. mexicanus* L., in southeastern Iowa, evidence was found of red ant, *Monomorium pharaonis* (Linne), predation in a newly hatched quail nest. This ant was identified by Dr. H. H. Knight, Department of Zoology and Entomology, Iowa State College. On July 5, 1946, a Bob-white nest containing 13 eggs was revisited six hours after the first egg had been found pipped. The clutch had hatched and there was no evidence of the new family at the nest or in the near vicinity. While recording the necessary data, a weak chick call was heard. Examination of the nest revealed a single egg at the bottom beneath 12 discarded shells. The cap of this egg had been partially pipped, so that the chick, which was still alive, could be seen. Several red ants were not only in the nest but were also moving in and out of the egg opening. Upon removal from the shell, the chick had no sense of balance but continued to *peep* when held in the hand. The ants

had eaten the flesh from the back of its head and neck. The chick died about six hours later. Only one of 46 nests under observation was parasitized by red ants.

Ant predation on quail chicks in the nest is not entirely unknown. Stoddard (The Bob-White Quail, pp. 193-194, 1931) reported considerable loss due to the thief ant, *Solenopsis molests* (Say), during his studies in southeastern United States. Mortality due to the red or Pharaoh's ant was unusual, for this species is resident around buildings and not normally found in the open fields (Metcalf and Flint, 'Destructive and Useful Insects,' p. 770, 1939). The nest from which these data were obtained was located in an open, bluegrass pasture, 80 rods from the nearest building and no red ant nests were found in the vicinity.—W. D. KLIMSTRA, Iowa Cooperative Research Unit, Iowa Agricultural Experiment Station, Ames, Iowa. (Journ. Paper No. J-1683, Project 494.)

Adoption of a Human Parent by Bob-white, *Collinus virginianus*, Chicks.—In looking through old correspondence, I came across the following in a letter from the well-known game bird propagator, William B. Coleman (then at the State Game Farm, Boulevard, Va.), dated September 28, 1925, which seems a good early record of the adoption by birds of a human "parent." "We have learned some very interesting things," wrote Mr. Coleman, "about the little quail from our experiments with the brooders. The birds soon learn to regard the keeper as their mother and when they are only a week old he can lead them from the brooder house to feed in the field for hours at a time and then lead them back again. Imagine having 200 baby bob-white quail all in the grass, without any fence or enclosure of any kind and not losing any of them. The keeper moves around over the field slowly, stopping every few steps to let the little birds feed all around him. If he fails to speak to them every few minutes they feel that they are lost and start calling but as soon as he speaks to them they get back to feeding at once with their satisfied little chirps." This letter bears also on the question as to the origin of large-scale rearing of quail with incubators and brooders.—W. L. MCATER, Chicago, Illinois.

Incubation Period of the Sandhill Crane, *Grus canadensis tabida*.—During the spring of 1949, in the Bernard W. Baker Sanctuary, Calhoun County, Michigan, I noted that a group of three cranes occupied one certain portion of the marsh. I watched these three cranes for some time at a prospective nest site on April 17. On April 21, I visited the spot and found an empty nest. During the early morning of April 27, I flushed a crane from this nest and found that the nest contained one egg. I marked this egg No. 1. Fearing desertion of the nest, I did not return until May 7, when I found the parent incubating two eggs. Jim Walkinshaw, Fred Woodard and Horace Bennett checked the nest during the late afternoon of May 26. They found No. 1 egg pipped with an opening about one-half inch in diameter. On May 27, during the late afternoon, I visited the nest but the young crane was not quite out. It completed hatching during the early morning of May 28, a period of at least 31 days after the egg was laid. No. 2 egg was infertile. Since cranes, as a rule, lay eggs on alternate days, the incubation period in this case was probably either 31 or 32 days. This agrees with the incubation period of other cranes obtained in captivity and of the European Crane, *Grus grus grus*, in the wild. Hoffmann found that in *G. g. grus* it required 30 days after a third egg was laid for the first egg to hatch, (Rund um den Kranich, 1936, Ferd. Rau, Oeringen).—LAWRENCE H. WALKINSHAW, 1703 Central Tower, Battle Creek, Mich.

Clapper Rail, *Rallus longirostris*, in Maine.—On December 13, 1949, Mrs. Leonard F. Bidwell of West Waldoboro, Maine, wrote that her cat had that day

brought to her a rail that he presumably caught down by the shore, one-half mile from the house. Mrs. Bidwell thought that it was a Clapper Rail, but she took the bird to Miss Jessie Keene, also of Waldoboro, for verification. The specimen was then sent to me at the Massachusetts Audubon Society in Boston for further confirmation of identification. A few days later Mr. James L. Peters, Curator of Birds at the Museum of Comparative Zoology, Harvard University, saw the specimen and also agreed that it was a Clapper Rail. It was a male and a bird of the year. The specimen, although in poor condition, has been preserved in part, and is now in the collection of the Department of Biology at Boston University.

I note in Palmer's 'Maine Birds' (1949) that there are only four previous records of the bird occurring in Maine, the bird sent in by Mrs. Bidwell being the first December record since 1875.—RUTH P. EMERY, 155 Newbury St., Boston, Mass.

Bridled Tern, *Sterna a. melanopectera*, taken at Dry Tortugas.—On September 7, 1949, the writer and his son were on the Tortugas, observing the fall migration. About mid-day, my son saw a strange tern flying over the moat at Fort Jefferson, but caught only a glimpse of it, as I did. All we could conclude at the moment was that it was not a Sooty Tern, *Sterna f. fuscata*, of which there were hundreds about. Two hours later, I picked up the bird or a similar one in one of the casements on the second gallery of the Fort. It was still alive, though sick and exhausted, its eyes closed and beak almost touching the brick flooring. It was in immature plumage, a phase I had never seen, but we concluded that it was *Sterna a. melanopectera*. The bird died shortly after, and the skin was sent to Dr. Alexander Wetmore. He confirmed the identification.

This is, apparently, the first specimen recorded from Tortugas, and seems to be the fifth specimen ever secured in Florida. Howell ('Florida Bird-life,' 1932) lists two specimens, one given by Audubon to George Lawrence, the other taken by Hoxie and now in the British Museum. Another was picked up dead at Cape Canaveral in October, 1945, by R. T. Peterson and A. B. Klotz. Another was secured by Charles Page at Daytona Beach, in April, 1949 (Fla. Nat., 23: 68). This bird is the third seen in south Florida waters by the writer. An adult was caught and banded near Tavernier, October 2, 1940; the other was seen near New Ground Shoal, about 25 miles east of Tortugas and between Tortugas and Marquesas keys, on June 21, 1946, the latter bird again being first noted by my son (Auk, 64: 141).—ALEXANDER SPRUNT, JR., *The Crescent, Charleston 50, S. C.*

Long-tailed Jaeger, *Stercorarius longicaudus*, from Montana.—While on a field trip at Nine-pipe National Wildlife Refuge, Lake County, Montana, in May, 1947, I picked up part of a bird skeleton which I was unable to identify. The trunk skeleton, except for the cervical vertebrae, was present and in addition the entire right leg with its tarsal covering, a tuft of breast feathers, and a tuft of feathers from the back. The specimen was submitted to Dr. Alexander Wetmore who reports that he is positive it is *Stercorarius longicaudus*. He points out that the small sternum and pelvis, the light colored tarsus and the dark colored toes are characteristic of this species. The bird probably died in 1946 or earlier. Apparently there are no previous records for this species from Montana.—PHILIP L. WRIGHT, *Montana State University, Missoula, Montana*.

Courtship in the Barn Owl, *Tyto alba*.—The several high and unused towers associated with some of the buildings of Gettysburg College, Gettysburg, Pennsylvania, have housed Barn Owls for many years. It was my good fortune to observe (and to hear of the observations of several students) what I presume to have been a

part of the courtship behavior of this species. On the night of January 5, 1950, peculiar sounds and flights of the owls were observed between 11:00 p. m. and midnight by Mr. Alexander Deanmead. The following night I spent some time on the campus to verify the report of Deanmead, but without success. However, on the night of January 11, 1950, I saw and heard the owls. The pair of owls flew in a column, follow the leader fashion, with one bird about 15 to 20 feet behind the leader. The course was a wide circle somewhat zigzagged laterally and with broad, vertically undulating waves. Throughout the flight the bird in the lead uttered a loud rapid *click-click-click* at a constant rate which I estimated to be about 200 per minute. Occasionally they departed from their circular course for a few minutes and were lost from the rays of light cast by a bright central lamp which serves to illuminate the central portion of the campus. The flight occurred between an estimated 20 to 50 feet above the ground.

Eight students presented reports which essentially corroborated my observation. I asked each of them to continue their observations, so far as possible, and found that flights were last noted on January 23; thus the display continued for at least 18 days. It is possible that two pairs of birds were courting over the same area, although only one pair was ever seen or heard at one time.—GEORGE E. GRUBE, Gettysburg College, Gettysburg, Pa.

Feeding Habits of Great Horned Owls, *Bubo virginianus*.—On February 26, 1949, I found a Great Horned Owl brooding two young on the north wall of the Museum of Natural History at the University of Kansas, Lawrence, Douglas County, Kansas. The nest was under an arch with three small windows separated by two stone abutments. The owls could walk along the entire length of the window ledge. The window farthest east was immediately behind the nest. A reserve food supply was maintained on that portion of the window ledge west of the nest.

The adult female was the only bird seen to feed or brood the young. At 2:45 a. m. on March 6, this bird, previously marked with white paint to make positive identification possible, had been feeding the young when it called twice from the nest. The sexes may be distinguished by an average difference of three, sometimes four, half tones of pitch in their hoots, the males being the lower (Miller, Condor 36: 207,

FOOD ITEMS BROUGHT TO NEST BY GREAT HORNED OWL
FEBRUARY 26, 1949, TO APRIL 6, 1949

	Decapi- tated	Head present	No record
BIRDS			
Domestic Pigeon, <i>Columba livia</i>	10	1	3
Meadowlark, <i>Sturnella</i> sp.	5	0	1
Starling, <i>Sturnus vulgaris</i>	0	0	3
English Sparrow, <i>Passer domesticus</i>	0	0	2
Tree Sparrow, <i>Spizella arborea</i>	0	1	0
Harris's Sparrow, <i>Zonotrichia querula</i>	0	1	0
American Woodcock, <i>Philohela minor</i>	1	0	0
Bronzed Grackle, <i>Quiscalus versicolor</i>	3	1	1
Coot, <i>Fulica americana</i>	2	0	0
Pied-billed Grebe, <i>Podilymbus podiceps</i>	1	0	0
Purple Martin, <i>Progne subis</i>	0	1	0
MAMMALS			
Rabbit, <i>Sylvilagus floridanus</i>	6	0	0
TOTALS	28	5	10

1934). The adult male did not appear until 8:00 p. m. on April 3, when the adult female called from the nest ledge and was answered by the adult male from a nearby elm tree.

The table shows that most of the food items brought to the nest ledge were decapitated, especially the larger forms. The adult owl would take the food from the reserve supply to the nest where it would be eaten at intervals during the day and night. For example, at 5:00 p. m. on March 24 there were three Bronzed Grackles on the nest ledge with one pigeon in the nest; all four birds were decapitated. By 3:45 p. m. the next day only one Bronzed Grackle remained outside the center window; but outside the west window was the wing, rump, tail and leg of a Coot. Then at 8:45 a. m. on March 29, a rabbit and one Pied-billed Grebe, both headless, were outside the center window. One wing of the grebe was in the nest. That night it rained and the next morning all the food had been eaten.—ROGER O. OLMSTED, 818 Alabama Street, Lawrence, Kansas.

First Breeding Record of Black Swift, *Nephoecetes n. borealis*, in Colorado.

—The Northern Black Swift, has been seen in Colorado on various occasions during the last 70 years. J. M. Drew collected ten individuals in 1881–1882 in San Juan County (Bull. Nutt. Orn. Club, 1881: 140, and 1882: 182). Widmann (Auk, 28: 313, 1911) saw five in July over Glacier Meadow. Other reports have placed them variously at the towns of Trinidad, Montrose, and in Huerfano County. Bailey and Niedrach of the Denver Museum of Natural History told us of seeing them in San Juan County some years ago, and with the approval and assistance of these two gentlemen, we undertook to discover the nesting place of these birds.

On July 21, 1949, we found a colony of approximately eight pairs nesting in a gorge in the San Juan mountains, adjacent to a 150-foot waterfall. This colony proved to be inaccessible without the use of elaborate mountaineering equipment. Three days later we found a more accessible colony 15 miles away. This colony was also in a gorge, adjacent to a series of waterfalls, and apparently consisted of six or seven pairs.

Both sites were located in the upper Canadian Zone, close to 10,000 feet, the terrain being typical of the rugged precipitous San Juan mountains. At the latter site, the falls had cut through the ancient igneous rock to a depth of 40 feet at several places. The nest we were able to reach was located 25 feet above a deep pool at the base of the largest falls in a cavity 10 inches high, 12 inches wide and 8 inches deep. The sun never shone on the nest.

We noticed that the swifts chose nesting sites close to falling water, most of them being subjected to a continuous spray. However, one nest was observed at least 20 feet from the nearest water and was quite dry. The nests are constructed of mud and moss, the moss continuing to grow on the nest. The males spend most of the day foraging far from the nesting area, returning at infrequent intervals, while the females incubate. The females occasionally leave their nests for short periods of time for the purpose of feeding.

On July 27, 1949, we photographed and collected a nest and its single egg, the first to be taken in Colorado and the female (DMNH 25551). The nest weighed 1.5 lbs. and the egg, 5.5 grams. All are now in the museum collection.—OWEN A. KNORR, Department Zoology, Colorado College, Colorado Springs, Colorado, and A. LANG BAILY, Denver Museum Natural History, Denver, Colorado.

Third Record of Black-chinned Hummingbird, *Archilochus alexandri*, in Oregon.—On May 15, 1949, while working in the greenhouse I found a dead male Black-chinned Hummingbird. The bird apparently died from hitting the glass in

his attempt to escape from the greenhouse. The bird was sent to Stanley G. Jewett of Portland, Oregon, who verified my identification.

The Black-chinned Hummingbird is included on the Oregon bird list on the basis of only two female specimens—this being the first male taken in the state.—BERTON M. BAILEY, *Enterprise, Oregon*.

The Race of Kingfisher, *Alcedo a. pallasii*, Occurring in the Crimea and Ukraine, South Russia.—Peters (Check-list Birds of World, 5: 172, 1945) places *Alcedo atthis suschkini* Pusanov (Bull. Soc. Nat. Moscou, Sect. Biol., 42: 15, 1933), from Crimea and Ukrainia, as a synonym of *Alcedo atthis atthis* (Linné), ('Systema Naturae,' ed. 10, 1: 109, 1758) from Egypt.

I have recently examined in the collection of the British Museum (Nat. Hist.) examples from the Crimea. I find that Crimean Kingfishers differ from Mediterranean *A. a. atthis* and western continental *A. a. ispida* Linné by their paler ventral surfaces and smaller proportions, and particularly in the shorter bill. On comparison with material from the Caspian Basin and Persia (*A. a. pallasii* Reichenbach), the Crimean specimens were found to correspond in all essential details, and I consider Pusanov's race *A. a. suschkini* to be a synonym of *Alcedo atthis pallasii* Reichenbach, (Handb. spec. Orn., 1851: 3) from Siberia, which must now be listed as ranging considerably farther to the west than hitherto recorded, that is to the Crimea and Ukraine.—P. A. CLANCEY, 9, Craig Road, Cathcart, Glasgow, S. 4, Scotland.

Scissor-tailed Flycatcher, *Muscivora forficata*, Feeding at Night.—In front of a hotel in Dublin, Erath County, Texas, during the evening of August 1, 1949, I noticed what I took to be a large bat fluttering around a streetlight. Further observation showed the creature to be an adult Scissor-tail. The bird perched on a nearby elm or on the electric wires, from which it made sallies to capture large insects. It appeared to be catching grasshoppers or katydids and often flew against the globe protecting the light in its pursuit of prey. I watched the performance from 9:15 to 10:00 p. m.

On August 2, I left Dublin but returned the following day. On the evenings of August 3 and 4, the Scissor-tail was busily catching insects until at least as late as 11:00 p. m.

The streetlight was of a large bulb-type, giving a blue-white light resembling that of a fluorescent tube.—PHILIP F. ALLAN, *Soil Conservation Service, Fort Worth, Texas*.

First Occurrence of Vermilion Flycatcher, *Pyrocephalus rubinus*, in Canada.—On Saturday, October 29, 1949, the writer and his wife, Dorothy, observed a Vermilion Flycatcher at the north end of Grenadier Pond in the northwest corner of High Park, Toronto. Many local observers saw the bird on October 30 and 31, and on November 1 it was collected by C. E. Hope for the Royal Ontario Museum of Zoology (No. 76565).

On dissection, it was found that the bird had a broken left femur which had completely healed. This defect did not seem to affect the bird's activity and it was flying well, associating with a mixed flock of migrating Bluebirds and Juncos. It showed no evidence of recent captivity and was fat and in good condition. Although its skull was completely granulated, it was an immature male, with vermillion feathers covering most of its underparts and a large part of its crown, and with a white throat.

This appears to be not only the first record of this species in Canada, but the first to be reported to the north of its usual northern limits in Utah, New Mexico, and Texas.

According to a report received at the museum from Dr. W. L. Godson, Training and Research Section, Meteorological Division, Dept. of Transport, Toronto, who searched the weather maps for a couple of weeks prior to October 29, there were only two situations which might be interpreted as having caused the displacement of this bird.

1. Starting on the evening of October 21 in the region around Utah, and brought about by a cold front from northwestern North America, there were strong west winds (20–25 m. p. h.) in the lower layers (1,000–2,000 feet) which changed to southwest winds before subsiding in southern Ontario 20 to 24 hours later. These bore warm air northeastward and the temperatures throughout the belt between Utah and Ontario, at the time, were uniformly "tropical."

2. A similar situation, during the evening of October 28, creating southwest winds from Utah, and subsiding during the afternoon of October 29 in southern Ontario.

Although it is possible that the first situation might have carried this bird to southern Ontario, or part way, and that it continued on to Toronto on its own volition, it seems unlikely that it was carried directly to Toronto and was present a full week before its detection October 29, as the area in which the bird was seen happens to be one of the most thoroughly inspected by field-observers in the immediate vicinity of Toronto.

It is the writer's opinion (concurred in by W. W. H. Gunn and J. L. Baillie) that the second situation (if either) was more likely to have been responsible for the presence of the bird so far north of its northern limits. The time of day when first observed (2:30 p. m. E. S. T., October 29) was approximately 20 hours subsequent to the development of the second disturbance in Utah the previous day, at almost exactly the time a small bird, if carried on those winds, would have reached southern Ontario.—THOMAS C. SWIFT, 206 Indian Grove, Toronto, Canada.

Model Planes and Purple Martins, *Progne subis*.—On July 4, 1949, I was watching an exhibit of model airplanes in a small field near Edgewater, Prince Georges County, Maryland. The planes were small gas-driven machines some two feet in length and were flown in a circle and controlled by means of a guy wire from the hand of the contestant to the tip of the wing of the plane. In this manner the model plane described a circle and performed numerous antics, such as loops, back loops, etc. These machines attain a speed of from 40 to 50 miles an hour, and their engines produce a continuous piercing hum. Many of the planes were parti-colored, although some were of solid color.

As is typical of many fields in this area numerous Barn Swallows, *Hirundo erythrogaster* were evident. At times the course of the planes crossed that of the birds, but the swallows wheeled out of the path and resumed their aerial feeding. Then suddenly a pair of Purple Martins appeared and dive bombed the model planes. There were several machines in the air at the time, but the martin selected to attack a machine with a deep purple fuselage and a yellow diagonal streak across each wing. Many attacks were made upon the yellow and purple machine, but the remaining planes did not attract the large swallows.—MALCOLM DAVIS, *The National Zoological Park, Washington, D. C.*

A Blue Jay, *Cyanocitta cristata*, Anting.—On August 16, 1949, my attention was drawn to a Blue Jay, perched upon the terminal branch of a white oak tree, *Quercus alba*. As I looked from my window, I observed the bird busily picking small objects from the leaves of the tree and inserting them beneath its feathers. After each insertion the bird uttered the typical Blue Jay scream. The bird engaged in

these maneuvers for about ten minutes. Through binoculars the objects inserted among the feathers appeared to be ants. These insects were placed deeply among the contour feathers, the feathers at the base of the tail, and the primaries.

I had never observed a bird that was anting and giving voice in apparent "ecstasy" during the process of anting.—MALCOLM DAVIS, *National Zoological Park, Washington, D. C.*

The Cedar Waxwing, *Bombycilla cedrorum*, at Juneau, Alaska.—The Cedar Waxwing has been recorded in southeastern Alaska (Swarth, Univ. Calif. Publ. Zool., 7: 97, 1911, and Willet, Condor, 23: 159, 1921, and Condor, 29: 59, 1927). Its occurrence in these latitudes, however, is decidedly far from common. Allen Brooks and Harry S. Swarth (Pacific Coast Avif., 17: 105, 1925) reported the species to be common in summer over the southern half of British Columbia, including Vancouver Island, while Munro and Cowan (B. C. Prov. Mus. Publ., 2: 184, 1947) reported that *cedrorum* in British Columbia is a common summer visitant to deciduous woodlands, north to the Skeena Valley and Peace River Parklands. It winters regularly in small numbers in the Puget Sound Lowlands and occasionally in the Okanagan Valley.

The previously published Alaskan records are from Wrangell and Ketchikan to the south, while there are no published reports on the occurrence of the species as far north as Juneau, Alaska. Clark P. Streator (Fish and Wildlife Service, Streator MS Report) while at Juneau, Alaska, from August 15 to 30, 1895, reported two or three seen and one female secured August 19, 1895, and sent to the U. S. National Museum where the specimen may now be found. My notes on the birds of Alexander Archipelago, southeastern Alaska, made during the past five years of residence at Juneau, refer three times to this species.

My first record of this species was made on December 2, 1948, when a single bird was seen in the company of: some 30 Bohemian Waxwings, *Bombycilla garrula*; two Rosy Finches, *Leucosticte tephrocotis*, referable to *littoralis*; two Pine Grosbeaks, *Pinicola enucleator*; and a Robin, *Turdus migratorius*. All were feeding in a berry-laden, mountain ash tree on the lawn at the Governor's Mansion.

The second record was made on August 22, 1949, at the author's Juneau residence. An adult was collected after it had been observed for some 20 minutes as it hawked for midges and other winged insects, much after the fashion of a typical flycatcher. This bird was using a high tension line as its point of vantage and would fly out to capture an insect, returning almost to the same perch. The specimen (now in the U. S. National Museum) proved to be an adult male, which, according to Herbert Friedmann, "is a very dark individual, considerably darker than most of the specimens we have here. On the underparts it appears to be somewhat stained which may partly account for its general darkness. However, this does not seem to apply to the top of the head or to the back of the neck which are unusually dusky . . ." Friedmann also stated that the female collected by Streator "does not have any particular dark cast to the plumage as does the bird you have sent in. I can see nothing about it by which it differs from other specimens . . . I find, however, that variation in tone, at least as far as our very large series of specimens is concerned, does not have geographic significance."

The third record was made September 1, 1949, after a single bird was seen in the company of several Robins, about four miles south of Juneau, at Sheep Creek, Alaska.

I am indebted to the authorities of the Fish and Wildlife Service for permission to record the Streator note and to Herbert Friedmann for his confirmation and report on the specimen collected.—RALPH B. WILLIAMS, *Box 2354, Juneau, Alaska.*

Recent Record of Bachman's Warbler, *Vermivora bachmanii*, from Gulf Coast of Mississippi.—During the course of a survey of eastern equine encephalomyelitis at Ship Island, approximately 16 miles offshore near Biloxi, Mississippi, the necessity for the collection of a sample of the bird life occupying the forested part of the island became apparent. On the morning of February 28, 1949, the writer was proceeding along one of the peculiar, tree-covered, low sand ridges which are a typical feature of the terrain of the eastern part of the island. A number of warblers were feeding in the upper level of the scrubby, gnarled live-oaks which occupy the backbone of this ridge. An obscurely marked and unfamiliar warbler attracted attention; the bird was quite wary and refused to allow close approach. After some difficulty, this individual was collected. It was suspected at this time that the bird was a Bachman's Warbler. A skin of this female was prepared by William W. Griffin. Dr. Friedmann of the United States National Museum has examined the skin and identified it as *Vermivora bachmanii*. As a routine investigative procedure, a thin-film blood smear was made from the bird at the time of collection. This smear, upon subsequent microscopic examination, failed to reveal the presence of blood parasites.

The record here reported is unusual in that this species, considered to be fairly common in restricted localities around 1900, has since so declined in numbers that Peterson ('Birds Over America,' Dodd, Mead & Co., 1948: 182) considers it, in recent years, to have "faded like a ghost." The last reported specimen known by the author was taken in 1941 on nearby Deer Island by Thomas D. Burleigh ('The Bird Life of the Gulf Coast Region of Mississippi,' Occ. Papers Mus. Zool., La. State Univ., No. 20: 440, 1944).—GEORGE W. SCIPLE, 100 Terrace Drive N. E., Atlanta 5, Georgia.

Winter Record of a Cape May Warbler, *Dendroica tigrina*, at Pimisi Bay, Ontario.—On November 23, 1949, a Cape May Warbler in fall plumage appeared at my feeding station. A full description of the bird together with a drawing was sent to Dr. Josselyn Van Tyne, Dr. Harrison F. Lewis, Mrs. Doris Huestis Speirs, and Mr. James L. Baillie, all of whom confirmed my identification. The bird remained in the locality four days when it was apparently killed by a Northern Shrike, *Lanius borealis*. During this time the weather was unusually cold, the lowest temperature registered was 9° below zero Fahrenheit, and there were 10 inches of snow on the ground. The bird was in excellent condition upon arrival and appeared surprisingly little affected by the cold; it travelled with a flock of Black-capped Chickadees, *Parus atricapillus*. Pimisi Bay is located about 20 miles north of the 46th north latitude. Two other winter records of this species are mentioned by Dr. Frank M. Chapman ('Handbook Birds Eastern North America,' D. Appleton-Century Co., New York, 1940: 457)—in the Bronx region, December 16, about 500 miles south of Pimisi Bay, and one seen by E. T. Keane and H. M. Halliday at Weston, Ontario, December 3, 1943, about 250 miles to the south.—LOUISE DE KIRILINE LAWRENCE, Rutherglen, Ontario.

The Name "Prairie Warbler."—This name has been objected to as not descriptive of the habitat of the bird, but not enough allowance has been made for diversity in meaning of the word prairie. Wilson who christened the bird says, "I first discovered it in that singular tract . . . in Kentucky, commonly called the Barrens" (Amer. Orn., 3: 87, 1811).

Such areas are characterized by a scrubby growth, particularly of oaks, and in fact usually are called "oak barrens." They may have been termed prairies also in Wilson's time for that word has other applications than the present dominating one

in reference to the vast open grasslands of the mid-continent. Areas designated as prairies range from great plains to openings in woodland, stream-side meadows, the coastal marshes of Louisiana, and pools with only low or submerged growths in cypress swamps as at Okefenokee, Georgia. There are trembling prairies, walking prairies, rolling prairies, and flat prairies, indeed gamuts are run in use of the term with respect to moisture, physiography, and vegetation. Hence argument about applicability of the name "Prairie Warbler" to *Dendroica discolor* tends to become academic. The difficulty of finding a practical solution is illustrated by the names suggested as substitutes, which include Bush, Hillside, Pasture, and Wildwood Warbler. None of these seems especially appropriate to me, for I have observed the bird in southern Indiana and in Maryland and Virginia near the District of Columbia almost exclusively in scrub pines, *Pinus virginiana*, 15 to 25 feet in height. In fact, seeing a rather open growth of such trees in the proper season was a stimulus to go look for this bird, and the probable result would be hearing its distinctive scale-climbing song before seeing the songster. Scrub-pine Warbler would be a fitting name for the species there, but my friend of olden days, A. W. Butler, writing of the Florida form (Auk, 48: 438, 1931), said "To me it is the Mangrove Warbler." As it appears hopeless to get a name of this type that will be appropriate over the general range of the species, for familiarity of the term alone, we may as well rest content with "Prairie Warbler."—W. L. McARTHUR, Chicago, Illinois.

Display of Oven-birds, *Seiurus aurocapillus*.—The following observation of the mating activities of two Oven-birds was made while conducting a census of breeding birds in the Elk Grove Forest Preserve in Cook County, Illinois, on May 30, 1949. The birds were in plain view and I watched them through 8-power glasses at a distance of 15 or 20 feet. I finally broke up the affair when I moved on.

One of the birds put on a lengthy display for the other which was perched about six feet from the ground in an ironwood tree. The displaying bird chose a dead branch on a tree some few feet in front of the other. Its foot-work reminded me of the "kneading" of the claws of a contented cat, only the action caused it to move along the branch. Its tail was tilted up and its wings were drooped and slightly outspread; the tip of each primary feather was separate and distinct. The elevated position of the tail revealed the anal region. The feathers on the underparts of the bird are usually whitish, but there appeared under the tail two pencil-lines of gray which converged at about a 35° angle about a quarter of an inch above the anus. The point of convergence and the anus were connected by two more gray lines arranged in an obovate shape.

I was able to make these notes carefully, as the bird for which the display was being made took no interest. I believe it was a sick bird as it looked "dumpy" and sat on its perch with the tip of its beak opening and closing about a sixteenth of an inch with each breath. Whenever it hopped to another perch, startled by a movement on my part, the displaying bird chose a new branch in front of it to make the display. I finally frightened the sick-looking bird away entirely, and the other attacked it in mid-air. It clung to it after it alighted on a branch and pecked it vigorously on the rump. The attacked bird did not fight back but sat there gasping as before, and the other desisted from its display.—F. J. FREEMAN, Iasca, Ill.

Northern Yellow-throat, *Geothlypis trichas*, Caught in Spider Web.—On September 4, 1949, Tom Foster and I saw this unusual sight. The warbler was making frantic efforts to get free. When we approached the bird its efforts increased and it became disentangled. It flew to a nearby bush where it spent some time

preening and freeing itself from the web. There had been a very heavy dew the night before, and the web was very wet. This wet condition of the web, it seemed to us, was a handicap to the bird in its efforts to free itself.—LUCRETIVS H. ROSS, *Bennington, Vermont.*

NOTES AND NEWS

TO ALL those who aided in preparing Volume 67 of 'The Auk' the Editor wishes to extend his sincere thanks. The Editorial Committee, composed of John T. Emlen, Jr., S. Charles Kendeigh, and Robert W. Storer, has borne much of the work of first-readings of manuscripts, but many others have helped occasionally.

Chandler S. Robbins, James L. Peters, and others have made possible the listing of titles in the section on Recent Literature.

The financial aid, in the form of gifts and subsidization of certain articles, has made possible the increase in the number of pages printed this year. All of us appreciate this help. Funds donated specifically for a colored illustration in each volume are now almost sufficient to start such a series, perhaps in 1951.

'THE AUK' has entered into an agreement with University Microfilms, Ann Arbor, Mich., to make issues available to libraries in microfilm form. Microfilm makes it possible to produce and distribute copies of periodical literature on the basis of the entire volume in a single roll, in editions of 30 or more, at a cost approximately equal to the cost of binding the same material in a conventional library binding. Sales are restricted to those subscribing to the paper edition, and the film copy is only distributed at the end of the volume year. The microfilm is in the form of positive microfilm and is furnished on metal reels, suitably labeled. Inquiries concerning purchases should be directed to University Microfilms, 313 N. First Street, Ann Arbor, Michigan.

Cecil Boden Kloss, Corresponding Fellow, died in England on August 19, 1949.

RECENT LITERATURE

A Sand County Almanac.—Aldo Leopold. (Oxford Univ. Press, New York) pp. xiii + 226, many ills. Oct. 27, 1949. Price, \$3.50.—This delightful book consists of three major sections: the first recounts some of the "nature experiences" of the Leopold family in its "vacation shack" in Wisconsin; the second is made up of personal illustrative examples of conservation issues in North America; and part three treats of some of the philosophical aspects of conservation. Throughout, is the theme that land is a community, that it is to be loved and respected, and that the cultural harvest of land has long been neglected and retarded by the ever present hope of the economic harvest.

Most of the material is presented in the form of personal reminiscences, each of which is replete with facts of natural history, which are presented in an easy, entertaining way. Each anecdotal account is interpreted in the light of the long experience of Aldo Leopold in forestry and wildlife work.

In sometimes barbed and pithy language he points out contradictions in our present attempts at conservation—the contour farming of hillsides to slow down runoff, and the straightening of streams to speed up runoff; the Wilderness Society wanting to exclude roads from "undeveloped" areas, to provide recreation, and the Chamber of Commerce wanting roads there, also for recreation; the hunter turned conservationist, "because the wild things he hunts for have eluded his grasp, and he hopes by some necromancy of laws, appropriations, regional plans, reorganization of departments, or other form of mass-wishing to make them stay put"; the sportsman relying on many gadgets to aid him in luring into his grasp those things he hunts, and often depending on professionals to tell him where he can get the most, with the least effort.

The ideas that this readable book sets forth are worthy of attention and review. To those who did not know Leopold, it furnishes a view into his beliefs and philosophy of life.—H. I. FISHER.

The Life of the White Stork.—Fr. Haverschmidt. (E. J. Brill, Leiden), pp. viii + 96, 20 pls., 4 maps, 1949.—Due to restrictions in printing, Mr. Haverschmidt was forced to eliminate much of the data available and to condense the remainder of the information to a very great extent. Nevertheless, this book presents a well balanced "Life of the White Stork."

Ranges, population densities, nest-life, behavior, food, reproduction, migration, and the results of banding returns are discussed in clear, readable terms. To me, the more significant parts are those on behavior at the nest, on the populations, and on banding returns.

Large conspicuous birds, with prominent nests, such as this one lend themselves readily to various methods of censusing, and data from 1929 to 1945 are presented to show fluctuations in numbers. It has been found, for example, that the greatest density of breeding birds of this species in 1934 was in Lwow, Poland, where 106 nests per square kilometer were found. One may also note that 12 to 20 per cent of the occupied nests never contain young and that the reproductive coefficient (here defined as number of young reared divided by number of nests occupied by pair of birds) varied from 0.3 to 2.7 from place to place and year to year.

Detailed data from banding experiments are used in defining migratory routes.

Observations on behavior at the nest are presented in easily read, interesting fashion and include much that has not been published previously. They are supple-

mented by 38 excellent photographs taken by the author. Each chapter has a substantial list of references.—H. I. FISHER.

An Annotated Checklist of the Birds of Malaya.—An annotated list of the birds occurring, or known to have occurred, in the territories of the Federation of Malaya and the Colony of Singapore.—C. A. Gibson-Hill. Bull. Raffles Mus., Singapore, No. 20, pp. 3-299, 3 maps, September, 1949.—This publication appears, at first glance, to be a reissue of the late F. N. Chasen's 'A Handlist of Malaysian Birds' (Singapore, 1935). But whereas the latter was a check-list in the narrow sense of the word, listing simply the names and broad geographical ranges of the birds occurring in the whole area of the Malaysian Subregion (excepting the Philippine Islands), Gibson-Hill's work treats of but a single Province, the Malayan, and gives us information, so far as possible for each form, on status, habitat, migration dates, breeding, etc.

It is pleasing to note that much previously unpublished information on the Malayan avifauna is here brought together, through the cooperation of an enthusiastic band of observers stationed in diverse sections of the Federation. It may be hoped that the check-list, by focussing attention on gaps in our knowledge, will intensify their interest and even bring them new recruits.

The nomenclature employed is, on the whole, that of the pre-war period. This could have resulted from the author's disagreement with the concepts of genera and species now generally held by American workers in Oriental ornithology, but is probably due, in large part, to the inaccessibility in Singapore of many of the pertinent revisions of the past ten years, a situation which our writers should take pains to correct. In any event, Gibson-Hill, by his choice of names, has no doubt better served the cause of the field observers of Malaya, who must constantly refer to the standard works of Chasen, Robinson, and Boden Kloss.

An appendix lists the birds that have been recorded from the peninsular provinces of Siam (south of the Isthmus of Kra), but are not yet known to reach Malaya, and a nine-page bibliography of the principal papers consulted contains many valuable references to the contents of the little-known 'Malayan Nature Journal.'—H. G. DEIGNAN.

Popular Handbook of Indian Birds.—Hugh Whistler. (Fourth Edition by Norman B. Kinnear. (Gurney and Jackson, London), pp. xxviii + 560, 24 pls. (7 col.), 105 text-figs., August 24, 1949. Price 22/6 net.—This fourth edition of Whistler's classic, first published in 1928, contains accounts of nearly 70 species that were not in the original edition; some 312 species are described, and about two-thirds of these are illustrated in the plates and figures by H. Grönvold and Roland Green.

The style is similar to that of other editions, but much additional information is given. Most accounts describe the sexes and give field characters, distribution of races, and habits, including song, breeding season, migration, nest, and eggs.—H. I. FISHER.

The Sandhill Cranes.—Lawrence H. Walkinshaw. Cranbrook Inst. Science, Bloomfield Hills, Mich., Bull. 29, pp. x + 202, illus., 1949.—For the past 15 years Dr. Walkinshaw has conducted an intensive study of the Gruidae and, in particular, of the Sandhill Crane, all four races of which he has studied in the field. The results of this concentrated effort, as gathered in the present volume, form an outstanding example of what an amateur ornithologist can accomplish. As would be expected by those familiar with the author's earlier life history studies, this monograph is crammed

with facts from cover to cover. No fewer than 31 tables supplement the text and there are charts and maps. All available data on the distribution, plumages, growth, and natural history of *Grus canadensis* are to be found here. In addition to a general bibliography, published distribution records for each of the four races are listed in an appendix. Yet another valuable feature is a key to the genera, species, and subspecies of cranes of the entire world.

'The Sandhill Cranes,' like other Cranbrook Institute books, has been substantially and attractively produced. A fine kodachrome of an Albertan crane taken by B. W. Baker serves as a frontispiece. Thirty-three excellent photographs by the author depict cranes and their nests, eggs, and young. Although only the Cuban race of the Sandhill Crane is presently threatened with extinction, the areas in the United States where this stately bird can be observed and studied are all too few. Let us hope that this published tribute will help it escape the fate of its larger white cousin, the Whooping Crane.—DEAN AMADON.

The American Wild Turkey.—Henry E. Davis. (Small-Arms Tech. Publ. Co., Georgetown, S. C.), pp. viii + 328, illus. with photos and gravures, col. frontis., 1949. Price, \$5.00.—There is in this anecdotal story of the turkey considerable information on habits, food, cover, characteristics, and distribution. However, this information is by no means complete, and some statements are apparently based more on hunting lore than on scientific fact. It seems unfortunate that the author did not refer to many of the modern papers on the turkey in an attempt to correlate and verify some of the data. For example, on page 12 it is stated that Shufeldt "has shown rather conclusively that their [races of fossil turkeys] previous existence is based more on conjecture than on evidence," and on page 284 the Red-tailed Hawk is credited with predation on adult turkey hens and is condemned.

Those interested in the Wild Turkey will find that the historical account (pertaining chiefly to South Carolina) has much to offer. In summary, it may be noted that approximately 100 pages are devoted to the biology of the turkey, 25 to its survival and perpetuation and about 200 pages to the best means of calling up and killing this bird. The latter part will appeal to the sportsman and hunter, but it does little to aid the cause of conservation which, as noted by H. R. Sass in the Preface, is one of the purposes of the book.—H. I. FISHER.

Hawks Aloft: The Story of Hawk Mountain.—Maurice Broun. (Dodd, Mead Co., New York), pp. xvii + 222, 11 photos, October 10, 1949. Price, \$4.00.—The first two-thirds of this readable and entertaining account treat of the history of the mountain, the people of the area, and the efforts (since 1934) of Mr. Broun, his wife, and other conservationists to establish this sanctuary in the face of considerable opposition. In a later part of the book are data on the numbers of hawks observed during 12 years of observation and the daily and seasonal occurrence of flights. In the species accounts of hawks is information on behavior, sex ratios, ratios of immatures to adults, and speeds of flight. Another section deals very briefly with other birdlife on the mountain.—H. I. FISHER.

Nature and Its Applications.—Jessie Croft Ellis. (Faxon Co., Boston), pp. xii + 861, 1949. Price, \$17.00.—To me, the title of this most amazing book is misleading; the contents consist of more than "200,000 selected references" to "illustrations of nature forms and illustrations of nature as used in every way." It includes "not only subjects of nature in their natural setting and form but also nature as used in art, sculpture, advertising, paintings, toys, and every form of decorative

design work." The book was designed primarily to aid librarians in filling requests for illustrative materials and is a new edition of "Nature Index" by the same author.

The material cited is primarily North American in origin, aside from references to encyclopediae. The effort necessary to compile these citations must have been enormous, and one can only wonder at the amount of work that would be involved in making a *complete* coverage of such a subject in the field of professional and semi-professional zoology. This index covers, in addition to other publications, only six North American journals.—H. I. FISHER.

Introduction to Quantitative Systematics.—Mont A. Cazier and Annette L. Bacon. Bull. Amer. Mus. Nat. Hist., 93: 343-388, 12 figs., 7 tables, 1949. Price, \$0.50.—This paper deals with elementary, descriptive statistics and instructs students of insect systematics how to use them. The objective is to encourage more systematists, beginners and old-hands, to use statistics to improve the accuracy of their interpretations. The text is addressed to systematists generally, but besides being written by entomologists its examples are entomological and, in a number of ways, the text refers to circumstances in insect systematics which do not obtain, for example, in avian systematics. Nevertheless, as an adequate and explicit introduction to the essentials of elementary statistics, this paper should be almost as useful to ornithologists as to entomologists.

Subjects discussed are sampling, selection of characters, measurement, preliminary treatment of raw data, frequency distribution, probabilities, correlation, and comparison of samples. Useful leads are given to other sources where the reader can expand his knowledge of many topics whose treatment of necessity, and evidently by design, is brief in this short paper.

Viewed as an effort to ease more students of systematics into the use of statistics, this paper is not vulnerable to criticism for certain omissions. Nevertheless, reference to methods of arranging calculations of mean and standard deviation other than that of the elaborate Tryon-Searle form would be desirable as also reference to the use of calculating machines. There are other and probably better ways of comparing samples graphically than the method described on pages 383-384 (see for example, Hubbs and Perlmutter, Amer. Nat., 76, 1942: 582-592, and Simpson, *ibid.*, 79, 1945: 95-96). It is misleading to the beginner to state (p. 379) that the examination of morphological trends along geographical axes or the demonstration of clines is a form of correlation and to do this in a section dealing with true correlation (*i. e.*, a constant relationship between two variates; see Simpson and Roe, 1939: 285). The one-paragraph discussion of clines on page 379 might better have been incorporated into the section of comparison of samples. In the latter section, it might help in the long run to emphasize that clines for different characters along a particular geographic axis do not necessarily parallel each other. There are risks in oversimplification, and they are as conspicuously taken in the discussion of character gradients and their bearing on systematic procedure as anywhere else in the paper. None of these matters, however, interferes seriously with the objective of the paper, and it is one which any systematist not at ease with elementary statistics will find helpful.—FRANK A. PITELKA.

Bobwhites on the Rise.—Verne E. Davison. (Charles Scribner's Sons, New York), pp. 1-150, line cuts, 1949. Price, \$3.75.—Davison has here directed his information toward the layman, the farmer, and the sportsman. In readable, non-technical fashion he reviews the past efforts at management of Bobwhites, pointing out fallacies, and attempting to show the simplicity of proper management.

Some may think the problem has been oversimplified. Some will be inclined to disagree with certain dogmatic statements, and others may well wonder if *bicolor lespedeza* and *multiflora rose* are really the panaceas the book (and other workers) would have us believe.

The down-to-earth facts and suggestions relating to management, and particularly to sportsman-farmer relationships, make this book desirable reading.—H. I. FISHER.

The Quails.—Edward S. Spaulding. (Macmillan Co., New York), pp. xii + 123, 7 col. pls., 1949. Price, \$6.50.—The author discusses, in non-technical terms, the seven species of quail that occur in the United States. The book is intended for sportsmen, to "increase the hunter's appreciation of the particular quail that he finds in his locality." In reading this book one is impressed by the amount of information that is presented; pertinent notes on characteristics, behavior, and the life history in general are from the author's observations. Occasional cited references to the literature aid in rounding out the story.

No claim for originality of the data is made, and most of the material is well known to the professional ornithologist. I believe, however, that the purpose of the book will be fulfilled, for it appears to be one of the best, if short, popular accounts of a small group of N. A. birds.

Each species is illustrated by a colored picture by F. L. Jaques.—H. I. FISHER.

Birds of Ceylon 1.—W. W. A. Phillips. (Ceylon Daily News Press, Colombo, Ceylon), 32 pp., 20 col. pls., 4 photos, and map. 1949. Price: Pop. Ed., \$0.75; Library Ed., \$1.50.—This little pocket-sized book is the first of two planned by the publishers in Ceylon in response to the growing interest in that country in birds. The second will be on the birds of the swamps and tanks.

No better observer of Ceylon birds exists than W. W. A. Phillips whose notes on the nests and eggs of the avifauna have been a most important continuing publication of the Ceylon Journal of Science. His concise descriptions of 20 of the commoner bird species of the island, each illustrated with a colored plate, are very useful indeed for the amateur. In addition there is a valuable section on bird watching, and a map of the Faunal Zones of the island, which is much clearer than those that have appeared in such recent works as Whistler's *Avifaunal Survey*. The illustrations suffer as usual from the quality of the reproduction process. The plates are by Mrs. Lushington, a resident of Ceylon, who has been a bird student there for many years. The birds are clearly enough represented and easily recognizable, but a trifle wooden to the modern taste. Mr. Phillips is to be congratulated for undertaking this task which should do a good deal to popularize bird study in Ceylon and develop the interest in conservation and nature-study on the island.—S. DILLON RIPLEY.

BOOKS AND OTHER PUBLICATIONS OF RECENT DATE

The Birds of the Republic of Colombia.—Their Distribution and Keys for their Identification.—Rodolphe M. de Schauensee (reprinted from 'Caldasia,' Bol. Inst. Ciencias Nat., Bogota, Colombia, 5 (22): 251-380, 1948, and 5 (23): 381-644, 1949).—The title is self-explanatory as to content except to note that all forms up to and including the Piciformes are listed. Of particular value is the section on the zoogeography, the families of birds found, and the gazetteer of place names.

The Second Annual Report of the Severn Wildfowl Trust.—(Country Life, Ltd., London), pp. 1-64, many photos and drawings, 1949.—In addition to the usual textual material to be found in such an organizational report, there are many excellent

photographs of ducks, geese and swans. Of special interest is the "key" to the Anseriformes by Peter Scott. This consists of black and white sketches (23 plates) with marginal notes on distinguishing characters. Opposite each plate is a brief summary of the distribution of the various forms depicted.

Exploring Our National Parks and Monuments. Sec. Edition.—Devereaux Butcher (Houghton Mifflin Co., Boston), pp. 1-224, many photos, 1949.—Included are short accounts of things of major interest in each area, including the plants and animals, brief descriptions of each area, and the best means of reaching each park or monument. Most of the many, excellent photographs are of scenery. There is a list of books and articles for further reading, as well as an index.

We note that volume I, number 1 of 'National Wildlife and Conservation Digest' published by Pike and Kaerne, 184 Lanark St., Winnipeg, Canada, has appeared. It will be issued monthly; subscription rate is \$3.00 per year or 2 years for \$5.00. The scope of interest is the entire North American continent, and the appeal is toward "the nature lover and the sportsman," with most articles coming from state conservation periodicals and sportsman's magazines.

Migration of Some North American Waterfowl.—A Progress Report on Analysis of Banding Records. John W. Aldrich and others. (U. S. Fish and Wildl. Serv., Spec. Sci. Rept. (Wildlife) No. 1: 1-48, many col. maps, 1949.—This report is concerned primarily with the ducks and teal; the only goose considered is the Canada. The colored maps for each species show banding and recovery sites. Thus, one may see at a glance the routes and distances covered; most of these pertain to movements in the fall.

Audubon's Birds of America.—Popular Ed. [Introduction and captions by Ludlow Griscom]. (Macmillan Co., New York), pp. 1-320, 288 col. pls., March 21, 1950. Price, \$2.95.—The present book was designed to bring some of Audubon's paintings before a wider audience. Hence, we may explain the reduction from 435 species, in the royal octavo edition of 1937, to the present 288, arranged in check-list sequence. What is not explainable and is inexcusable is the poor reproduction of colors in many plates; in some the overlay of the various plates in the color process was inaccurate. These two factors produce a fuzziness that is unfortunate and is not characteristic of Audubon (see, for example, numbers 87, 214, 234, 254, 257, 285). Although it is seldom that one may buy colored illustrations for a penny apiece, it is doubtful if these are worth that.—H. I. FISHER.

ALDER, L. P. 1950. Notes of Great White Heron [*Egretta alba modesta*]. Brit. Birds, 43 (4): 125.

ALEXANDER, W. B. 1950. The index of heron population, 1949. Brit. Birds, 43 (3): 78-80.

ALLERT, O. P. 1950. Snowy Owls in Clayton County. Iowa Bird Life, 20 (1): 23.

ALLIN, A. E. 1950. A list of the birds of Port Arthur—Fort William and vicinity. Thunder Bay Field Nat. Club Newsletter, 4 (3): 1-4.

AMANN, FRITZ. 1949. Starke Schwankungen im Bestand des Waldlaubsängers (*Phylloscopus sibilatrix*, Bechst.). Orn. Beob., 46 (5): 148-150.

AMANN, FRITZ. 1949. Junge Kohlmeisen (*Parus major*) und Blaumeisen (*Parus caeruleus*) im gleichen Nest. Orn. Beob., 46 (6): 187-190.

AMANN, FRITZ. 1950. Körperliche Abnormitäten bei Vögeln. Orn. Beob., 47 (1): 7-9, 1 photo.

- ANDREW, D. G. 1950. Display by young Great Crested Grebes [*Podiceps cristatus*]. Brit. Birds, 43 (4): 126-127.
- ANONYMOUS. 1950. He had an Umbrella Bird in 1909. Animal Kingdom, 53 (2): 44-46, 2 figs., 2 photos.
- ANONYMOUS. 1950. Christmas bird census—1949 [Canada]. Can. Field-Nat., 64 (2): 71-73, 77-82.
- ARAGONE, ANGELO. 1950. Cattura di Canapino maggiore [*Hippolais icterina*] con colorazione anomala. Riv. Ital. Orn., 20 (2): 72-73, 2 figs.
- ARNOLD, JOHN R. 1950. An albino Murre [*Uria aalge californica*]. Condor, 52 (3): 141.
- ASH, JOHN. 1950. Intruder responses in birds outside their breeding areas. Brit. Birds, 43 (2): 54-55.
- AUSTIN, CLAUDE N. 1950. Further notes on the birds of Dunk Island, Queensland. Emu, 49 (4): 225-231.
- BAGG, A. M., ET. AL. 1950. Barometric pressure-patterns and spring bird migration. Wilson Bull., 62 (1): 5-19, 2 figs.
- BÄHRMANN, UDO. 1950. Über das individuell Variieren des Gefieders der Schwarzdrossel (*Turdus merula merula* L.). Vogelwelt, 71 (3): 82-85.
- BARRUHL. 1950. Observation d'un Pic tridactyle dans les Préalpes de Savoie. Oiseau, 20 (1): 78-82, 2 figs.
- BARRUHL, PAUL. 1950. Quelques observations de la Chouette chevêchette [*Glaucidium passerinum*]. Oiseaux, 20 (209): 165-172, 3 figs.
- BÄSECKE, KURT. 1950. Zum Brüten der Rabenkrähe im vorjährigen Nest. Vogelwelt, 71 (2): 53.
- BAUMGARTNER, FREDERICK M. AND A. MARGUERITE. 1950. Lark Bunting [*Calamospiza melanocorys*] in Central Oklahoma in winter. Wilson Bull., 62 (1): 36.
- BEEBE, WILLIAM. 1950. Home life of the Bat Falcon, *Falco albicularis albicularis* Daudin. Zoologica, 35 (4): 69-86.
- BEECHER, WILLIAM J. 1950. Convergent evolution in the American Orioles. Wilson Bull., 62 (2): 51-86, 10 figs.
- BEHREND, FRED W. 1949. A survey of upper east Tennessee birds and their habitats. Migrant, 20 (2): 26-32.
- BELCHER, CHARLES F. 1950. Notes on some eggs collected in Northern Nyasaland. Ool. Rec., 24 (1): 1-10.
- BENT, ARTHUR C. 1950. Life Histories of North American Wagtails, Shrikes, Vireos, and their allies. Order Passeriformes. U. S. Nat. Mus. Bull. 197: 1-411, 48 pls.
- BERGER, A. J., AND HOFSLUND, P. B. 1950. Notes on the nesting of the Alder Flycatcher (*Empidonax traillii*) at Ann Arbor, Michigan. Jack-Pine Warbler, 28 (1): 7-11, 1 table.
- BERGER, A. J. 1950. Nesting of the Yellow-breasted Chat (*Icteria virens*) at Ann Arbor, Michigan. Jack-Pine Warbler, 28 (1): 14-15.
- BERGMANN, H. 1950. Blattlausvertilgung durch verschiedene Vogelarten. Vogelwelt, 71 (2): 56-57.
- BERLIOZ, J. 1950. Quelques Observations Ornithologiques en Norvège. Oiseau, 20 (1): 64-77.
- BETTS, A. H. 1950. Call note of Yellow Bunting [*Emberiza citrinella*]. Brit. Birds, 43 (2): 56-57.
- BLACK, C. T. 1949. Seasonal records of Michigan birds—spring migration, 1949. Jack-Pine Warbler, 27 (3): 111-127.

- BLACK, C. T. 1949. Iceland Gulls [seen] in Michigan, March, 1949. *Jack-Pine Warbler*, 27 (4): 169.
- BLIESE, JOHN C. W. 1950. An aid in counting birds in flight. *Iowa Bird Life* 20 (1): 24.
- BLIESE, JOHN C. W. 1950. Bewick's Wren [seen] at Mount Vernon. *Iowa Bird Life*, 20 (1): 24.
- BOASE, HENRY. 1950. Calls of Tawny Owl [*Strix aluco*]. *Brit. Birds*, 43 (3): 86.
- BOND, JAMES. 1950. A large Sandpiper [*Actitis macularia*] clutch. *Wilson Bull.*, 62 (2): 93.
- BOND, JAMES. 1950. Notes on Peruvian Formicariidae. *Proc. Acad. Nat. Sci. Philadelphia*, 102: 1-26.—*Myrmotherula leucophthalma dissita* (Chifiri, Río Kaka, La Paz, Bolivia); *Myrmotherula sunensis yessupi* (Puerto Yessup, Junín, Perú), new subspecies.
- BOND, JAMES. 1950. Results of the Catherwood-Chaplin West Indies Expedition, 1948. Part II. Birds of Cayo Largo (Cuba), San Andrés and Providencia. *Proc. Acad. Nat. Sci. Philadelphia*, 102: 43-68.
- BORDEN, RICHARD. 1950. Early Woodcock [*Philohela minor*] nesting failure. *Wilson Bull.*, 62 (1): 40-41.
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OBITUARIES

FRIEDRICH KARL HERMAN VON LUCANUS.—According to the 'Ornithologische Berichte' (1: 122, 1947), Colonel Friedrich Karl Hermann von Lucanus, retired officer of the German Army and a Corresponding Fellow of the American Ornithologists' Union, elected in 1923, died early in May, 1947.

However, a letter received from the Bürgermeister of Buschow states that the late ornithologist passed away on February 18 of that year in Buschow (West Havelland) Germany.

Little is known of his last years since he was one of the many displaced persons after the war, but until 1946 he was listed as residing at Lessingstrasse 32, Berlin N. W. 87, Germany. His son, Hermann von Lucanus, is, in a measure, carrying on the father's work, especially with the birds of prey and his present address is Hameln/weser Klut str. 28. Land Niedersachsen British Zone, Germany.

Friedrich von Lucanus was born in Berlin on June 20, 1869, and early in his adult life, took up the study of bird migration, making observations on height and speed of flight. In 1901 he presented a paper on this subject at the Fifth International Zoological Congress at Berlin. This was issued separately in 1904 under the title, Die Höhe des Vogelzuges und seine Richtung zum Winde auf Grund aeronautischer Beobachtungen.

Another book on migration appeared in 1922, entitled, Die Rätsel des Vogelzuges; ihre Lösung auf experimentellen Wege durch Aeronautik, Aviatik und Vogelberingung, with a second edition coming out in 1923.

A more general book by Col. von Lucanus is Das Leben der Vogel, published in 1925. This work treats of structure, development, breeding, song, flight, and distribution, but is a more amateurish book, and was not so well received as those on migration.

In 1937, 'Deutschlands Vogelwelt' was published. This is a large, attractive volume on the natural history of birds, with 56 colored plates by Karl Wagner, Georg Krause, and August Dressel.

Colonel von Lucanus served as President of the Deutsche Ornithologische Gesellschaft from 1921 to 1926 (for further information see Degner's Wer Ist's 2, 1935).—
ELSA G. ALLEN.

WILLIAM CLARK ADAMS, an Associate of the American Ornithologists' Union, died suddenly at his home in Albany, N. Y., June 12, 1948, at the age of 68. He was born in Wooster, Ohio, May 21, 1880. He was appointed to the Massachusetts Board of Fish and Game Commissioners in 1913 and served as chairman from 1916 to 1928. In 1931 he was made Director of Fish and Game on the New York Conservation Commission, a position which he filled until his death. Thus he devoted 32 years, or nearly one-half his life, to wildlife conservation administration.

He was elected an Associate of the A. O. U. in 1920 and contributed two papers to 'The Auk.' One of these, published in 1924, while he was chairman of the Massachusetts Commission, was entitled 'Fisher on Scientific Collecting,' the other in 1931, while associated with the New York Conservation Commission, was on 'Wild Life Administration and the Fish and Game Commissioner.' Both will well repay occasional rereading by ornithologists as well as by game officials.—T. S. PALMER.

EMELINE CLARK BATES, an Associate of the American Ornithologists' Union, elected in 1920, died in Chicago, Ill., May 13, 1935, at the age of 61. She was born in Phenix, Rhode Island, February 23, 1874. She was educated at the Wyndham Connecticut High School, Willimantic School, and graduated from Mount Holyoke College in the class of 1897.

She was well known as a student of bird life and in addition to her membership in the A. O. U., she was a member of the Chicago Ornithological Society and the Geographical Society.—T. S. PALMER.

FREDERICK MONROE DILLE, an Honorary Life Associate of the American Ornithologists' Union, died at Nogales, Ariz., January 24, 1950. He was born at Wiloughby, Ohio, February 20, 1865, and went to Greeley, Colorado, as a small boy, where he graduated from the high school and in 1892 moved to Denver. Here for 40 years he lived on the western plains in a triangular area marked by Denver, Colo., Valentine, Nebr., and Rapid City, S. Dak. He was elected an Associate of the Union in 1892 and 40 years later became a Life Associate. For some years he was associated with the U. S. Biological Survey (now the Fish and Wildlife Service) and was in charge of the Niobrara Reservation near Valentine, Nebr., and also had charge of the installation of buffalo and other big game there and on the Wind Cave National Game Preserve. From December, 1913, to July, 1914, he served as Acting Superintendent of the Wind Cave National Park.

Dille was much interested in photography and illustrated his monthly field reports with Kodak pictures of things to which he wished to call attention. In 1938 he moved to Nogales, Ariz., where he operated a book and nature studio but always retained his interest in birds and wildlife protection.

One of his first papers on birds, published in 1885 at the age of 20, was entitled 'Nesting of *Archibuteo ferrugineus*.' During the next 23 years he published a dozen brief notes in the 'Young Oologist,' 'Ornithologist and Oologist,' 'Nidologist' and 'Condor,' but most of his records were summarized in an article on 'Notes of Occurrence of Certain Species Additional to the Birds of Colorado,' which appeared in 'The Auk' in 1909. He also contributed notes to W. W. Cooke's 'Birds of Colorado,' 1897, and W. L. Sclater's 'History of Colorado Birds,' 1912.—T. S. PALMER.

MURRAY THOMPSON DONOHO, an Associate of the American Ornithologists' Union, elected in 1925, died in Baltimore, Md., August 29, 1935, at the age of 70. He was born at East New Market, Md., Jan. 19, 1865.

Mr. Donoho was interested primarily in field observations on birds and especially in migration. He was an active member of the Audubon Society of the District of Columbia and a regular attendant on the outings. Always a careful observer, he devoted much time and effort to recording observations on the summer roosts of the Purple Martin, which for several years formed an outstanding feature of summer bird life of the National Capital. He did not attend out-of-town meetings of the A. O. U., but was present and took part in the Washington meeting in 1927.—T. S. PALMER.

LILLIE ROSE ERNST, an Associate of the American Ornithologists' Union, elected in 1933, died in St. Louis, Mo., December 6, 1943, at the age of 73. She was born in St. Louis, September 14, 1870, and educated in the Clay and Ames Schools, Central High School, and Washington University. She was a member of Phi Beta Kappa fraternity and received an honorary degree of M.A. from her alma mater.

After graduation she taught at the Central High School, served as principal of the Cote Brillante, Mark Twain and Blewett high schools, and was appointed assistant Superintendent of Instruction. She was an outstanding educator and civic leader and once was selected as one of St. Louis' ten leading women. In addition to her membership in the A. O. U., she was a Director of the St. Louis Bird Club, the St. Louis Children's Hospital, and the Urban League of St. Louis, and honorary member of the Wednesday Club. She was also a member of the National Education Association, National Society for the Study of Education, and the Alpine Club of Canada.

A brochure containing a brief biography by Wayne Short and notes in memory of Miss Ernst was published by the St. Louis Bird Club in 1944.—T. S. PALMER.

POMPEO MARGHERITA MARESI, an Associate of the American Ornithologists' Union, elected in 1939, died of cerebral hemorrhage in Newport Hospital, Newport, R. I., August 13, 1940, at the age of 51. He was born in Brooklyn, N. Y., in 1889, graduated from Princeton University in 1909, and later received his law degree from Columbia University. He was a founder of the American Agricultural Society.

At his home in Scarsdale, N. Y., he maintained an aviary where he specialized in raising foreign finches, but he apparently published nothing especially on birds.—T. S. PALMER.

ROBERT BAIRD McLAIN, a Life Associate of the American Ornithologists' Union, died at Monrovia, California, November 15, 1946, at the age of 69. He was born at Wheeling, W. Va., August 16, 1877, and received his collegiate education at Stanford University, Calif. In 1893 he was elected an Associate of the A. O. U. and while still an undergraduate in college joined the Cooper Ornithological Club. He lived for many years in Wheeling but about 1927 moved to southern California, residing for some time at Hollywood, and spent the last years of his life at Monrovia.

His first publication as a member of the Cooper Club was a protest on the inclusion in the Check-list of North American Birds instead of in the Hypothetical List, of such doubtful forms as the Violet-throated Hummingbird and the Farallon Rail. Shortly after graduation he published several papers on herpetology, and in 1898 and 1899 contributed several brief notes on uncommon species to 'The Auk,' but in later years, apparently, he published little or nothing further on birds.—T. S. PALMER.

ANNIE ELIZABETH MIDDAGH FALGER (Mrs. William Falger), an Associate of the American Ornithologists' Union, elected in 1918, died of scarlet fever at Modesto, Calif., August 2, 1923, at the age of 48. She was born at Scio, Allegany Co., N. Y., December 16, 1875. For some years she lived in North Dakota where she was much interested in birds. Later she moved to California where her husband was connected with a bank in Modesto. Here she continued her interest in birds and bird protection and took an active part in the work of the local Audubon Society.—T. S. PALMER.

EDWIN LINCOLN MOSELEY, an Associate of the American Ornithologists' Union, elected in 1918, died of coronary thrombosis in Bowling Green, Ohio, June 6, 1948, at the age of 83. He had been stricken in Dayton, Ohio, on April 28. He was born in Union City, Mich., March 29, 1865, and graduated from the University of Michigan in 1885 with the degree of A.M. For 29 years he taught science in various high

schools of Michigan and Ohio, except from 1887 to 1889 when he was a member of the J. B. Steere Zoological Expedition from the University of Michigan to the Philippine Islands. Among the birds collected on this expedition was a new species of kingfisher from the island of Negros, described by Steere as *Halcyon moseleyi*. In 1914 he was appointed head of the department of biology at Bowling Green State University and held that position until 1936 when he retired as professor emeritus. He was also curator of the University Museum.

Moseley was an authority on meteorology and was deeply interested in long range weather forecasting. He formulated a theory that rainfall in a certain area, repeats itself in cycles of 90.4 years or four times the period of the magnetic sun-spot cycle. His prophecies of excessive rain in the Ohio Valley and subnormal rainfall in New York in 1939 proved accurate and attracted wide attention. In 1919 he published 'Trees, Stars and Birds', a 400-page textbook with 300 illustrations, as a guide to outdoor sciences.

Prof. Moseley was unmarried and was survived by a nephew, Charles F. Chubb of Pittsburgh, Pa., and two nieces, Mrs. Edwin Idler of Prospect, Ky., and Mrs. Lillian Brown of Wilmette, Ill.—T. S. PALMER.

CLIFFORD HAYES PANGBURN, an Honorary Life Associate of the American Ornithologists' Union, died at St. Augustine, Florida, December 16, 1949, at the age of 61. He was the son of Lycurgus Elmer and Annie Elizabeth Hayes Pangburn and was born in Washington, D. C., November 18, 1888. In 1907, when elected an Associate of the Union, he resided in New Haven and later graduated from Yale University in the class of 1912. During 1914 and 1915 he lived in New York and later took up his residence at Chappaqua, Westchester Co., N. Y. Here he remained until about five years before his death when he made his home in St. Augustine. During World War I he served in France and after the war retired as a major in the Army Reserve Corps.

Pangburn's first visit to Florida was made in the early part of 1918, at St. Petersburg from January 22 to April 29, when he was convalescing after an operation for wounds received during the war. His observations on 135 species of birds made during this time appeared in 'The Auk' for 1918 under the title 'A Three Month's List of the Birds of Pinellas County, Fla.'. In 1935 he published 'Some Additional Notes on the Birds of Pinellas Co., Fla.', adding five species to his earlier list. For more than 40 years he took part in the annual Christmas Bird Censuses and regularly sent in reports of his observations.—T. S. PALMER.

CLARENCE BAYLEY RIKER, an Honorary Life Associate of the American Ornithologists' Union, died at South Orange, N. J., January 2, 1947. He was born at Creskill, N. J., on November 9, 1863, the son of Andrew J. and Caroline E. Tyson Riker. In June, 1884, at the age of 20, he made a vacation trip up the Amazon as far as Santarem, where he remained a month collecting birds and other natural history material. A second trip was made to the same region in June and July, 1887. A report on the 400 birds collected on the two trips was published in 'The Auk' for 1890 and 1891. Among the birds collected at Santarem was a new species described by Ridgway as *Picolaptes rikeri*. Apparently the only other bird paper that he published in these early years was a note on '*Helminthophila leucobronchialis* in New Jersey' which appeared in 'The Auk' in 1885.

Riker was elected an Associate of the Union in 1895 and became an Honorary Life Associate in 1935. For many years he served as one of the Investment Trustees of the Union. Among entomologists his name is associated with the 'Riker Mount' for exhibiting large specimens of butterflies and moths, which was placed on the market in the nineties.—T. S. PALMER.

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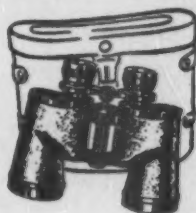
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